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Economic Impact Analysis of Alternative Pollution Control Technologies: Wet Process and Insulation Board Subcategories of the Timber Products Industries

Arthur D. Little, Inc.
Cambridge, MA

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Abstract - Hardboard/Insulation Board

The Economic Impact Analysis Assessment of the Hardboard/Insulation board industry is a support document for the effluent limitations (Best Available Technology, Pretreatment Standard for Existing Source, Pretreatment Standards for New Source, New Source Performance Standards) promulgated pursuant to Sections 301, 304 and 306 of the Clean Water Act, on January 7, 1981. The report includes an industry characterization (processes, market structure and financial information), industry costs from compliance from the effluent limitations and an economic impact analysis for existing and new sources resulting from the effluent limitation.

Wet process hardboard is made from inter-felted wood fiber, using a wet forming and either a wet or dry pressing process. Hardboard products include interior paneling, exterior siding and industrial use products. There are 16 wet process plant operated by 11 producers. In 1976, the median, after-tax profit for a 200-million-square foot wet process hardboard plant was about 7%; the industry range was from 1% to 13%.

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Insulation board is made from inter-felted ligno-cellulose fibers, using a similar process to the fourdrinier paper making process. Primary products include structural and decorative fiberboard products. (ceiling tile, roof instulation etc.) The 17 insulation board plants are operated by 12 companies. The median after-tax profitablity is about 3% of sales, with a range from less than zero to 7%.

Total annualized compliance costs for wet process hardboard were $2,558,000 for option 1 and $7,473,000 for option 2. There are no costs for the insulation board industry because all instulation board plant were in compliance with the effluent limitations.

Economic impacts for wet process hardboard include anticipated price increase ranging from 1-16% for option 1 and 0-23% for option 2, using a total cost pass-through analysis Profitablity analysis was also conducted. One plant may close as a result of the effluent limitations regulations.

PREFACE

This document is a contractor's study prepared for the Office of Water Regulations and Standards of the Environmental Protection Agency (EPA). The purpose of the study is to analyze the economic impact which could result from the application of effluent standards and limitations issued under Sections 301, 304, 306 and 307 of the Clean Water Act to the timber products industry.

The study supplements the technical study (EPA Development Document) supporting the issuance of these regulations. The Development Document surveys existing and potential wastewater treatment control methods and technology within particular industrial source categories and supports certain standards and limitations based upon an analysis of the feasibility of these standards in accordance with the requirements of the Clean Water Act. Presented in the Development Document are the investment and operating costs associated with various control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the application of various control methods and technologies. This study investigates the effect in terms of product price increases, employment changes, the continued viability of affected plants, and other competitive considerations.

The study has been prepared with the supervision and review of the Office of Water Regulations and Standards of EPA. This report was submitted in fulfillment of Contract No. 68-01-4194 by Arthur D. Little, Inc.

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I. EXECUTIVE SUMMARY

A. SCOPE OF WORK

The U.S. Environmental Protection Agency (EPA) is required by Section 301 (d) of the Clean Water Act to review and revise, if necessary, effluent limitations promulgated pursuant to Sections 301, 304, and 306 within five years of promulgation of these regulations. This study presents an economic impact analysis of alternative pollution control technologies for the insulation board and wet process hardboard subcategories of the timber products industry. It characterizes each industry subsegment; summarizes alternative technologies and their related costs of compliance,* and analyzes and discusses the anticipated economic impact on those plants that would have to make investments to be in compliance with alternative regulation options. The EPA assisted in the analysis by surveying the board products segment of the timber products industry through a Financial Survey.

The study does not address the costs and economic impacts that might or might not be incurred as a result of other environmental or other Federal regulations, such as EPA solid waste regulations, EPA air pollution regulations, EPA pesticide regulations or Occupational Safety and Health Administration regulations.

This analysis was based upon data provided by affected plants reflecting 1976 operating costs and conditions. Also, costs of compliance generated by the Technical Contractor are based upon 1977 equipment and materials prices.

B. INDUSTRY CHARACTERIZATION

1. Insulation Board

The insulation board industry comprises establishments engaged in the production of structural and decorative fiberboard products constructed from inter-felted ligno-cellulosic fibers and having a density of less than 31 pounds per cubic foot.

In 1977, twelve companies, one of which is privately held, operated 17 insulation board plants in the United States. Since then, one plant has closed and one plant has stopped producing insulation board; and one plant manufactures insulation board from a fiber other than wood and thus is not included in the regulatory category. Eleven of these companies are large, diversified corporations: five have major interests in forest products, and six have major interests in other building products. The twelfth company is exclusively in insulation board. One company has four insulation board plants, one has three plants and the other 10 have one plant each. Six of the seventeen plants can also manufacture hardboard.

The basic operating technology of the industry is very similar to the fourdrinier papermaking process and has not changed substantially since its inception. Plant capacities range from 54 million to 400 million square feet, ½" basis, but stated capacities can vary according to the product mix.

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*Derived from References 1 and 2, the U.S. Environmental Protection Agency and Environmental Science & Engineering, Inc. (ESE).

Ten of the seventeen plants are located in the South, with the remainder in Maine, Michigan, Minnesota, Pennsylvania and Oregon. Plant locations are evenly distributed among rural, suburban, and urban areas.

Insulation board products are primarily used in the construction industry as building board, insulating roof deck, roof insulation, ceiling tile, lay-in-panels, sheathing and sound-deadening board. Between 1965 and 1976, U.S. production fluctuated between 7 billion square feet, ½" basis, and 3.9 billion square feet. The value of shipments in 1976 was estimated by the U.S. Department of Commerce at $275 million.

However, insulation board is threatened by substitute products and/or technologies, such as fiberglass, mineral wool and other foam board insulation, in many of its applications. Thus, in contrast to an average annual growth rate of 1.6% from 1965 to 1976, Arthur D. Little, Inc., forecasts a decline at an average annual rate of 5% into the 1980's.

Since 1960, the industry has become more concentrated: currently four companies (Celotex, Armstrong Cork, Weyerhaeuser, and United States Gypsum) operate 56% of U.S. capacity. As insulation board is capital intensive compared to other competing wood products and requires a secure wood source, there are significant barriers to the entry of new firms.

Since 1965, price changes in insulation board have been moderate compared to price changes of other wood products with which it competes, possibly as a consequence of superior performance of other products. The median value of after-tax profitability is about 3% of sales, with a range from less than zero to 7%.

2. Wet Process Hardboard

The wet process hardboard industry comprises establishments producing hardboard in densities generally ranging from 31 to 68 pounds per cubic foot from inter-felted wood fiber, using a wet forming and either a wet or dry pressing process.

There are 15 producers operating 28 wet and dry process plants in the United States. The industry is composed of 3 private firms and several large, public corporations. Of the 15 hardboard producers, 7 operate more than one hardboard plant. Wet process plants represent 16 of the 28 facilities and are operated by 11 producers; 4 of these producers operate more than one wet process plant.

As with the insulation board industry, hardboard mills frequently are integrated back to raw materials sources, as owners of woodlands and the larger publicly owned companies also operate captive distribution systems that handle a portion of their output. The remaining producers sell their products through independent wholesalers or through the captive distribution systems of other companies.

Hardboard products serve four general markets; interior paneling, exterior siding, industrial, and the do-it-yourself consumer. Most of the mills have associated fabricating facilities to produce a wide variety of finished products.

In 1978, shipments from domestic plants totaled 7.9 billion square feet, reflecting an average annual growth rate of 7.9% since 1964. Imports have ranged from 4.6% to 15.6% of domestic consumption during the 1970's. Volumes vary, depending on the level of U.S. demand, and tend to be at the lower-value end of the market. During the same period, domestic consumption has grown at 7.5% per year, totaling an estimated 6.8 billion square feet, 1/8" basis, in 1978.

While wet process hardboard plants generally compete in the market against the output of dry process mills, the latter use minimal amounts of process water and are closed systems. Wet process mills are those operations that use a pulping process that requires large amounts of water and a wet system similar to the paper process.

An average wet process plant produces about 230 million square feet, 1/8" basis, with individual plant capacities ranging from 52 to 1850 million square feet (MMSF). Of the 16 wet process plants in the United States, 9 were constructed before 1958, 6 between 1958 and 1967, and 2 since 1968. No new wet hardboard plants have come on stream since 1971; however, several locations have added substantial capacity. While Arthur D. Little, Inc., forecasts future growth in demand at about 3% per year, it is highly likely that capacity additions to meet this increased demand will come in the form of incremental expansion at existing facilities or perhaps through the conversion of under-utilized insulation board capacity.

The five largest firms (Masonite, Abitibi, Weyerhaeuser, Boise-Cascade, and Superwood) operate more than 70% of total hardboard and wet process hardboard capacity. As with insulation board, there are significant barriers to the entry of new firms, including its capital intensity, market structure, need for a fiber source, and the required distribution network.

In 1978, the median, after-tax profit for a 200-million-square-foot wet process hardboard plant was about 7%; the industry range was from 1% to 13%.

C. CURRENT EFFLUENT STATUS AND COST OF COMPLIANCE

Plants producing only insulation board have no compliance costs. Of the ten wet and one wet-dry process plants producing only hardboard, nine discharge into navigable waters, one discharges into municipal sewers and one has no discharge. Of the five plants producing both insulation board and hardboard by the wet-dry process, three discharge into navigable water, one into a municipal system, and one has no discharge. Many plants have pollution control equipment in place and, for several plants, current treatment will be sufficient to meet revised effluent guidelines. However, seven plants producing wet process hardboard may be required to install new equipment to meet the promulgated regulations.

Investment costs under the two control options defined by the Environmental Protection Agency for wet process hardboard range from $163,000 to $7.4 million, depending on the size of the facility and the control option defined (Table I-1). Annual operating costs range from $51,000 to $2.3 million. Annualized costs for the plants impacted under Option 1 are $4.2 million and for the plants impacted under Option 2 are $7.5 million. (See Appendix C for an explanation of the methodology for calculating annualized costs.)

TABLE I-1

COST OF COMPLIANCE FOR PLANTS AFFECTED BY REVISED EFFLUENT REGULATIONS (1977 $000)

Option 1 (BPT)	Type of Product	Investment			Operating Costs	Annualized Cost
		Total	Land	Other Investment		
Plant 2002	S1S	285	5	280	51	117
Plant 2003	S2S	7,266	40	7,226	2,215	3,437
Plant 2004	S1S	2,005	159	1,846	292	653
Total Option 1		9,556	204	9,352	2,558	4,207
Option 2 (BCT)						
Plant 2001	S1S	6,856	188	6,668	796	1,942
Plant 2002	S1S	1,105	46	1,059	107	361
Plant 2003	S2S	7,436	40	7,396	2,300	3,550
Plant 2004	S1S	2,938	300	2,638	394	920
Plant 2007	S1S	183	0	183	101	128
Plant 2012	S1S	599	0	599	103	241
Plant 2099	S1S	1,228	30	1,198	107	331
Total Option 2		20,345	604	19,741	3,908	7,473

Sources: References 1 and 2. Environmental Science and Engineering, Inc., the U.S. Environmental Protection Agency, and Arthur D. Little, Inc., estimates.

A candidate new source performance standard (NSPS) for insulation board and wet process hardboard plants calls for zero discharge. The total investment required also varies by plant size and process type, and ranges from $2.0 million to $5.1 million for wet process hardboard. Land requirements for an S1S wet process hardboard can be up to 300 acres.

D. ECONOMIC IMPACT OF COMPLIANCE WITH REGULATIONS

An analysis of economic impact of the revised water effluent regulation options was performed for each of the seven affected plants. The price increase required to recover the cost of compliance varies widely among the wet process hardboard plants but, in general, Option 1 as Best Practical Technology (BPT) will produce a lower impact upon hardboard firms than would Option 2 as Best Conventional Technology (BCT). (Table I-2).

Hardboard, on average, is expected to be in tight supply over the next five to ten years, with demand estimated by Arthur D. Little to increase at approximately 3% per year. To satisfy this demand, new capacity will be necessary. The minimum price necessary to support new capacity is more than $140 per thousand square feet in 1978 dollars.* This price is 79% higher than the 1976 price and is higher than any price increase necessary for the affected plants to recover cost

* See Chapter III, Table III-7.

TABLE I-2

REVENUE REQUIRED TO RECOVER THE COST OF
COMPLYING WITH REVISED REGULATIONS FOR HARDBOARD PLANTS

Plant Type/Code	(1) 1976 Revenue ($000)	1976 Price* $/MSF	Recovery of Compliance Cost	
			Required Δ Revenue $/MSF	% Δ 1977 Price
Option 1				
Plant 2002	20,000	78	0.80	1
Plant 2003	>30,000	78	9.93	13
Plant 2004	8,400	78	9.96	14
Option 2				
Plant 2001	>30,000	78	4.02	5
Plant 2002	20,000	78	2.60	4
Plant 2003	>30,000	78	10.23	14
Plant 2004	8,400	78	17.94	23
Plant 2007	9,600	78	1.75	2
Plant 2012	>30,000	78	0.30	0
Plant 2099	5,500	78	8.30	11

*The average price for wet process hardboard for 1976.

Sources: EPA Financial Survey, and Arthur D. Little, Inc., estimates.

increases and maintain profitability (Table I-2). Thus, most existing firms should eventually be able to recover the cost of compliance because they would be able to produce hardboard at a lower cost than a new facility.

Profitability of wet process hardboard plants affected by revised regulations would be reduced in the absence of price increases and all but one plant would cover cash costs and depreciation, assuming that the 1976 operating costs are representative of cost conditions likely to prevail in 1984. To the extent that price increases to support new capacity outstrip cost increases for the affected plants, the reduction in profitability occasioned by the regulation will be mitigated.

The EPA is proposing Option 1 as the Best Practicable Pollutant Control Technology (BPT) and Option 2 as the Best Conventional Pollutant Control Technology (BCT) for wet process hardboard. Under Option 1, two plants have capital requirements of less than 100% of cash flow, and one of between 200% and 350%.* Under Option 2, two plants have capital requirements of less than 100% of cash flow, two of 100% to 200%, and three of 200% to 350%.

Insulation board plants will be unaffected by the proposed regulations. However, one hardboard plant, 2003, may close as a result of Options 1 or 2 because of the large capital

* See Appendix C for a discussion of the cash flow calculation.

requirements and the reduction in plant profitability. If this plant closes, approximately 250-400 jobs will be affected, with attendant effects on community employment.

As is discussed in Chapter V, new hardboard capacity probably will be built at existing plants rather than at greenfield sites because the market price required to support a new facility is almost twice the 1976 price. Therefore, the hardboard industry will not be affected significantly by revised new source regulations.

II. INDUSTRY CHARACTERIZATION — INSULATION BOARD

A. INDUSTRY DEFINITION

The insulation board industry (a subset of the building board industry, SIC 2661) comprises establishments engaged in the production of structural and decorative fiberboard products constructed from inter-felted ligno-cellulosic fibers and having a density of less than 31 pounds per cubic foot.

B. TYPES OF FIRM

1. Size of Firms

Twelve companies, one of which is privately held, operate the 17 insulation board plants in the United States (Table II-1). Eleven of these companies are large diversified corporations, five have major interests in forest products and six have major interests in other building products. There are only two multi-plant companies; Celotex, the largest producer, operates four plants and U.S. Gypsum operates three.

TABLE II-1

SALES BY INSULATION BOARD MANUFACTURERS, 1977
($ million)

Company	Total Corporate	Insulation Board
Abitibi Paper Co., Ltd.	880	12
Armstrong Cork	981	31
Boise Cascade	2316	16
Celotex/Jim Walter[1]	525/1422	59
Flintkote[2]	587	16
Georgia Pacific	3675	16
Huebert Fiberboard	2	2
Kaiser Gypsum[2]	212	12
National Gypsum	748	15
Temple/Time Inc.	340/1038	17
U.S. Gypsum	1177	21
Weyerhaeuser	3283	23

1. Fiscal year ended August 31.
2. Since 1977, the insulation board operations of these two firms have been owned by Owens-Corning Fiberglas.

Sources: Dun and Bradstreet Directory, 1978, Directory of Corporate Affiliates, 1978, and Arthur D. Little estimates of insulation board sales based on 80% of capacity and $97/MSF, 1/2".

The percentage of sales revenues contributed to each company by insulation board products varies considerably from company to company (Table II-1). Although they may hold sizeable insulation board capacity, most of the companies are involved in many other businesses and do not have significant capital committed to the industry relative to their total business. Annual sales of the 12 companies, including sales from other operations, such as lumber, plywood, and non-wood products, range from $2 million to more than $3.6 billion (Table II-1). In relation to their total corporate sales, their sales of insulation board products are insignificant except for Huebert Fiberboard, for which it is close to 100%.

2. Integration/Diversification

Most insulation board firms are fully integrated backward to timber ownership or control and forward to distribution systems. Insulation board is usually manufactured to take advantage of waste from other wood products mills and to broaden the company's product line.

Four of the insulation board firms (Abitibi, Boise Cascade, Georgia Pacific, and Weyerhaeuser) have major capital interests in various segments of the paper industry as well as a full spectrum of building products. Temple Industries, a subsidiary of Time, Inc., produces a wide range of solid wood products.

Five of the firms involved in the insulation board industry (U.S. Gypsum, National Gypsum, Kaiser Gypsum, Flintkote and Celotex, a division of Jim Walter Corporation) are highly diversified into both residential and nonresidential building materials. Armstrong Cork has major interests in residential and commercial interior finishing materials, including floor coverings, wall coverings, and furniture. The general building products firms produce insulation board to complement their product lines. While these firms are characterized by well-developed captive distribution systems, they generally are not integrated backward to timber control. The remaining company, Huebert Fiberboard, is privately held and insulation board constitutes its major business.

C. PRODUCT DESCRIPTION

1. Types of Products

Insulation board is known in the marketplace under many different names, i.e., fiberboard, sheathing board, backer board, or asphalt board. Insulation board products can be divided into seven major categories, as follows:

- *Building Board* — a general-purpose product for interior construction.
- *Insulating Roof Deck* — a three-in-one component which provides roof deck, insulation, and a finished interior ceiling surface. Insulation board sheets are laminated together with waterproof adhesives.
- *Roof Insulation* — insulation board designed for use on flat roof decks.
- *Ceiling Tile* — insulation board embossed and decorated for interior use. It is also valued for acoustical qualities.
- *Lay-in-Panel* — a finished tile board used in suspended ceilings.
- *Sheathing* — a board used in exterior construction because of its insulative and noise control qualities, its bracing strength, and its low price.
- *Sound Deadening Insulation Board* — a special product designed to control noise levels in buildings.

The American Society for Testing and Materials, American National Standards Institute, U.S. National Bureau of Standards, and other agencies set standard specifications for these and other product categories.

2. Market Size and Future Growth

Between 1965 and 1976, total U.S. production, as reported by the U.S. Department of Agriculture, has fluctuated between a low of 1.13 million tons (3.0 billion square feet, ½" basis) in 1968 to a high of 1.55 million tons (3.9 billion square feet) in 1973 (Table II-2). Production as measured against new construction volume (the predominant end market for insulation board) also shows this relative stability. Six plants closed between 1960 and 1972 and operations at two more plants were severely cut back in 1977. Since 1965, production of insulation board per billion dollars of new construction has fluctuated between 13,800 and 19,800 tons, although total U.S. production in 1976 was still below the 1973 peak (Table II-2). Arthur D. Little expects insulation board demand to decline at a rate of 5% per year.

TABLE II-2

PRODUCTION OF INSULATION BOARD, 1965-1976

Year	Total[1] (000 tons)	Square Feet, ½" (millions)	Production Per $ Billion of New Construction[2] (000 tons)
1965	1258	3334	15.9
1966	1155	3061	14.5
1967	1176	3116	15.1
1968	1133	3002	13.8
1969	1352	3595	16.4
1970	1219	3194	15.5
1971	1446	3839	16.9
1972	1529	3918	16.6
1973	1547	3914	16.6
1974	1295	3282	16.2
1975	1240	2960	17.9
1976	1450	3407	19.8

1. Annual growth rate, 1.6%.
2. Constant 1967 dollars.

Note: Government import/export data on this industry are unreliable. The volumes are generally offsetting and less than 2.5% of sales; therefore, the data are not shown.

Source: "The Demand and Price Situation for Forest Products, 1976-1977" USDA, Forest Service Miscellaneous Publication 1357.

Trade directories indicate that 64% of the world's insulation board capacity is in the United States. Government data on insulation board imports and exports are unreliable. As the volumes are small and offsetting, the data are not shown. However, according to U.S. Forest Service data, imports have generally been less than 2.5% of domestic production.

Interior products account for 30% of the total production (on a ½-inch basis) and are mainly prefinished building board and ceiling tile (Figure II-1).* Exterior products, principally sheathing board and roof insulation board, represent 58% of production. The remaining 12% includes insulation board used in industrial applications, principally trailer (mobile home) board.

The largest interior products market has traditionally been nonacoustical ceiling tile and lay-in panels. This market has dropped from 530 million square feet in 1972 to 321 million square feet in 1976, largely as a result of the inclusion of stricter flame spread requirements in building codes. The product, which had been widely used in nonresidential construction, is now limited to the residential repair and remodeling market. Improvements in some fire resistance qualities helped the acoustical tile market grow from 172 million square feet to 201 million square feet over the 1972-1976 period and kept regular tile products from losing even more of their market. Over the same period, sound-deadening board has suffered heavy market losses, with volume slipping from 114 million square feet to 46 million square feet.* The future of the interior products markets is highly dependent on the ability of the manufacturers to develop a better fire resistant board. Arthur D. Little forecasts that the interior products market will decline 5-6% annually through 1982.

The largest of the exterior products markets is sheathing. In this application, insulation board is frequently used as a backup to brick veneer. Over the period from 1972 to 1976, sheathing volume decreased from 1,608 million square feet to 1,368 million square feet; however, 1972 insulation board sheathing production was the highest in the past nine years.* The availability of price-competitive products and the fact that many building codes permit exterior wood sidings to provide rack** resistance, previously provided by plywood sheathing or brick, are forcing a cutback in the insulation board sheathing market. Also, insulation board sheathing products have an insulation resistance value (R-value) of approximately 2.64 (°F ft². Btu/inch), which is considerably lower than that of most true insulation products like fiberglass and foams. Furthermore, the sheathing panels are usually ½ inch thick, with a resulting R-value of only 1.32, which is less than what is being required in energy conserving construction.

Gypsum sheathing is insulation board's chief competitor in the sheathing market. The 1977-1978 housing boom, however, has caused a shortage of gypsum, thus resulting in more insulation board being used than would otherwise have been the case. Gypsum is a good example of a preferred cost-competitive product. New products such as foil-backed structural foams are also competing in the sheathing market. On the other hand, roof insulation board made a recovery between 1972 and 1976, with production going from a nine-year low of 261 million square feet in 1972 to 549 million square feet in 1976. As a result, over the 1972-1976 period, the total exterior products market volume has increased 1.6%. The exterior product demand will weaken as housing construction slows and as capacity comes on-stream from competing products

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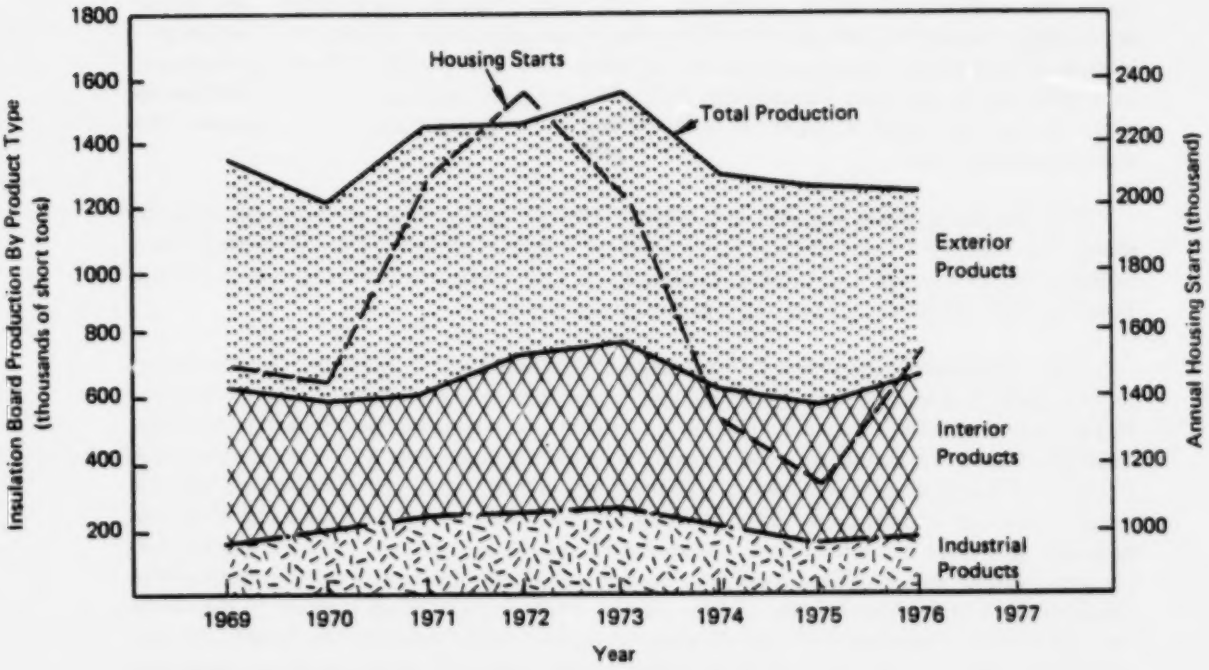
* For a more detailed breakdown, see Appendix A.

**Racking strength — the ability of the structural unit to withstand shear and bending stresses resulting from various building loads.



Source: U.S. Department of Commerce, *Current Industrial Reports*, M26A.

FIGURE II–1 INSULATION BOARD PRODUCTION, 1969–1976

(approximately 10 plywood mills and at least two foam panel plants are under construction). In view of these downward pressures on demand, Arthur D. Little staff members who are knowledgeable about the construction products industry forecast the exterior products market to drop by 2.5-3.0 percent annually through 1982.

The industrial market for insulation board has declined from a nine-year high of 718 million square feet in 1972 to 418 million square feet in 1976. Most of this loss is attributable to a decline of 243 million square feet over the 1972-1976 period in the trailer board market, which was largely a result of flame spread requirements in mobile homes. The use of insulation board for expansion joint strips has also declined dramatically. Arthur D. Little staff members who are knowledgeable about the various products industries estimate that the industrial market will decrease 7-8% annually through 1982.

The insulation board industry is indirectly affected by the level of hardboard imports; should the hardboard demand growth require more domestic capacity, some insulation board capacity can be converted to produce hardboard. A conversion from hardboard to insulation board capacity, although it is not likely, is technically feasible.

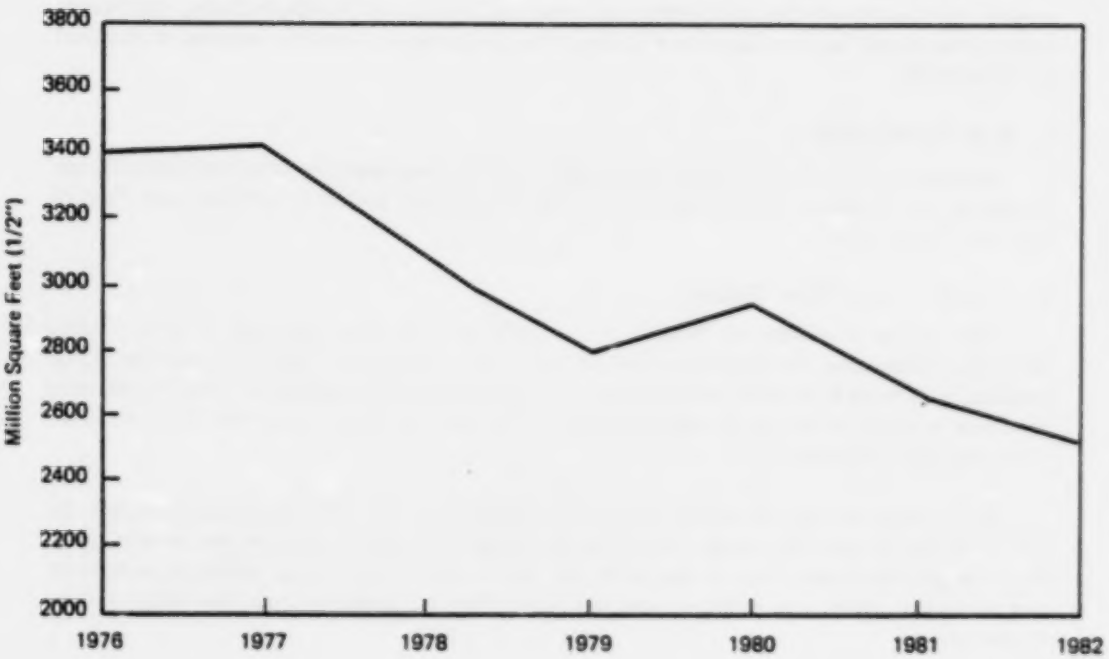
Most insulation board is used in remodeling or new construction; therefore, the demand for it is cyclical. To minimize the influence of cyclicality, various historic growth rates were calculated (based on data in Appendix A, Table A-1), using a least squares time trend line. Over the 1969-1976 period, the market for exterior insulation board products grew at 0.74% per year, while interior and industrial products grew at an annual rate of 0.55% and -1.6%, respectively, and the weighted average annual growth rate for total production was 0.35%. At the same time, the economy in general has experienced real growth of about 3.0% per year, thus confirming that insulation board has lost market share to competitive products. The factors which contributed to the favorable supply/demand balance for insulation board in 1977-78 are temporary; the strong housing market combined with the shortage of gypsum sheathing will not persist. Further competition from competing products will become more intense as production of new composite board sheeting products increases. In view of these considerations, the aggregated market for insulation board is projected to decline at an average rate of 5% annually through 1982 (Figure II-2). However, because of the cyclicality of construction, this market will reflect the same short periods of growth and construction typical of most building materials.

D. PLANT CHARACTERISTICS OF THE EXISTING INDUSTRY

1. Process Technology

The basic operating technology of the industry, which is fully described in the Development Document, is very similar to the fourdrinier paper process and has not changed substantially since its inception. A cylinder screen type of mat forming system is also used. Some technical improvements have been made in the fiber refining stage of the production process.

Technical changes in the product, such as printing and patterns, also have had a significant effect on the industry and have been market-driven. These have resulted in production process modifications.



Source: Arthur D. Little, Inc., forecast.

FIGURE II–2 INSULATION BOARD DEMAND, 1976–1982

2. Size of Plants

Existing plant capacities, on a ½ inch-thick basis, range from 50 million to 400 million square feet (Table II-3), averaging 182 million square feet. The mix of structural and tile products at a given mill can have a substantial effect on the stated mill capacity figures. For example, because of trim losses and product configuration, a mill that produces interlocking ceiling tile will produce 20% less board than an identical mill producing sheathing. Plants producing prefinished building board and lay-in ceiling tile will also have trim losses considerably in excess of identical sheathing mills.

3. Age Distribution

Age generally is a factor in overall plant efficiency because operating rates and flexibility are limited by age. Twelve of the plants are more than 20 years old and all but one are more than 10 years old (Table II-4).*

4. Location and Fiber Supply

Nine of the 17 plants are located in the South and the remainder are in Iowa, Maine, Michigan, Minnesota, Pennsylvania, and Oregon. This distribution developed because of the availability of wood fiber close to the markets and insignificant competition for wood resources in the South at the time the plants were constructed. The sites are evenly distributed between rural, suburban, and urban areas.

Wood resources that are owned or controlled under long-term contracts typically supply 30-50% of the plants' raw fiber needs. The remainder of each plant's fiber requirement is made up by open market purchases. Four of the mills are part of multi-plant forest products production complexes and derive a substantial portion of their fiber requirements from the waste of other operations.

5. Employment

The 1972 Census of Manufactures indicates that the industry supported 6,100 employees on a payroll of $59 million. Most of the plants operate with more than 200 employees (Table II-5).

E. CHARACTERISTICS OF NEW PLANTS

In the past nine years, only one new insulation board plant has opened. Since 1960, six plants have shut down. In 1976 and 1977, two large plants announced major cutbacks in their operations. In 1978, Georgia Pacific was expected to add hardboard siding capacity in Jarratt, Virginia, to its insulation board and to operate both production lines. No companies have announced any intentions, plans, or desires to build additional insulation board capacity.

F. COMPETITIVE STRUCTURE

1. Market Structure

Since 1960, when 23 insulation board plants were operated by 17 firms, the industry has become more concentrated. Currently, the top three firms control 47% of industry capacity and the top five firms control 63% (Table II-6). As product demand declines and plants close or convert to other products, the industry is expected to become even more concentrated.

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*The Celotex plant in Marrero is excluded from this analysis because it does not use wood fiber as a raw material but is included in the discussion in order to present a complete picture of the industry.

TABLE II-3

INSULATION BOARD PLANTS IN THE UNITED STATES, 1977

Company	Location	Annual[1] Capacity (MMSF-1/2")	Other Products Manufactured
Abitibi	Blountstown, FL[3]	150	
Armstrong Cork	Macon, GA	400[2]	
Boise Cascade	International Falls, MN	210	Hardboard
Celotex	Dubuque, IA	737	
Celotex	Marrero, LA[4]		
Celotex	L'Anse, MI[3]		
Celotex	Sunbury, PA[3]		
Flintkote	Meridian, MS[5]	200	
Georgia Pacific	Jarratt, VA[3]	210	Hardboard (1978)
Huebert Fiberboard	Boonville, MO	50	
Kaiser Gypsum	St. Helens, OR[5]	150	
National Gypsum	Mobile, AL	192	
Temple Industries	Diboll, TX	220	Hardboard
U.S. Gypsum	Lisbon Falls, ME	271	
U.S. Gypsum	Pilot Rock, OR[3]		Hardboard
U.S. Gypsum	Greenville, MS		Hardboard
Weyerhaeuser	Broken Bow (Craig), OK	300	Hardboard
Total[6]		3090	

1. These capacities are approximate because they depend upon product mix. Figures quoted are for mills operating 24 hours/day, 6-2/3 days/week, 50 weeks/year.
2. Understated due to heavy tile production. If operated as a sheathing mill, capacity would increase 20%.
3. No effluent.
4. Not considered in this analysis because the mill uses Bagasse, not wood fiber, as the raw material.
5. Since 1977, the plants at both locations have been acquired by Owens-Corning Fiberglas Co.
6. Since 1977, Abitibi/Blountstown has closed and U.S. Gypsum/Greenville has stopped producing insulation board.

Sources: 1976 *Directory of the Forest Products Industry*, American Board Products Association, and Arthur D. Little, Inc., estimates.

TABLE II-4

AGE DISTRIBUTION OF
INSULATION BOARD PLANTS

Age (Years)	Number of Plants
0-19	5
20-29	5
30+	7
Total	17

Source: EPA Financial Survey.

TABLE II-5

EMPLOYMENT LEVEL OF
INSULATION BOARD PLANTS

Number of Employees	Number of Plants
0-199	5
200-299	5
300-399	3
400+	4
Total	17

Source: EPA Financial Survey.

TABLE II-6

CONCENTRATION IN THE
INSULATION BOARD INDUSTRY

Firm	% Capacity
Celotex	24
Armstrong Cork	13
Weyerhaeuser	10
U.S. Gypsum	9
Temple	7
All Others (7)	37
Total	100

Sources: American Board Products Association, and Arthur D. Little, Inc., estimates.

2. Pricing Mechanism

The economic justification for construction of insulation board plants was based on the use of waste from other forest products mills as the basic raw material supply. Initially, this raw material was very inexpensive; but, since 1972, increased competition for wood chips and rising energy, labor and pollution control costs have increased insulation board costs (Table II-7) along with the cost of other wood products.

Insulation board prices are usually quoted on the basis of dollars per thousand square feet, f.o.b. shipping point, with full freight allowed to the destination. Between 1965 and 1976, insulation board sheathing prices increased 57%, including a 30% increase since 1972. Since 1965, the price of ceiling tile has also increased 57%, but the increase since 1973 has been only 15%. Ceiling tile prices reflect the higher value-added manufacturing steps and are more than double the price of sheathing. While the percentage increases for the 1965-1976 period are equal, the absolute dollar price increases for ceiling tile are more than double the price increases for sheathing. However, the price increases for insulation board products have been about equal to the rate of inflation and therefore real prices have been constant.

The major pricing constraint for insulation board is created by price levels of substitute products rather than intra-industry competition. The price comparisons must be made on the basis of performance value, not unit costs. The triple role of insulation board as a structural, decorative, and insulation product makes price comparisons particularly difficult. To illustrate, the March 1977 price of ½-inch insulation board sheathing was $58.71 per thousand square feet, while the price of ½-inch plywood sheathing was $190. On this basis, the insulation board appears to be a better value. However, in use, a siding material must be applied over the sheathing. An alternative wall construction is to use fiber glass insulation and a plywood or hardboard siding product that provides the strength of the sheathing, a finished outside wall, and

TABLE II-7

PRICES OF SELECTED INSULATION BOARD PRODUCTS[1], 1965-1978
(dollars per thousand square feet)

Year	1/2-Inch[2] Sheathing	Roof Insulation[3] Board	Ceiling Tile[4]
1965	37.09	63.78	83.05
1966	36.45	65.15	83.75
1967	36.01	65.02	87.24
1968	38.17	64.17	91.78
1969	40.73	65.15	97.88
1970	36.91	67.16	103.38
1971	37.78	66.06	109.14
1972	42.06	66.19	112.28
1973	44.98	67.56	113.32
1974	49.23	84.59	117.16
1975	50.20	100.13	121.87
1976	58.31	107.80	130.42
1977	66.05	N/A*	N/A*
1978 (March)	74.87	N/A*	N/A*

1. F.o.b. mill, with freight allowed to destination.
2. Standard density, 1/2" x 2' x 8' to 4' x 9', with asphalt impregnation or water-resistant coating, manufacturer to wholesaler.
3. 1" x 2' x 4', asphalt treated, manufacturer to roofing contractor.
4. 1/2" x 1' x 1', 1 x 2', or 1 x 3', factory-painted plain surface, beveled edges, manufacturer to wholesaler or retailer.

*Not available.

Source: U.S. Bureau of Labor Statistics.

a better R-value for the complete wall. The construction costs of the fiber glass/siding wall are less than a sheathing/siding wall and the higher-quality insulation will result in lower long-term heating costs. Ultimately, what appeared to be a major price advantage for insulation board becomes insignificant. Gypsum sheathing has been very competitive with insulation board on a price/utility basis for years and has established itself as the preferred sheathing material in many areas on the basis of performance. Structural foams are also beginning to appear on the market and will also compete strongly with insulation board on the basis of performance value.

In the past, commercial structures have used large quantities of insulation board for ceiling tile, lay-in panels, and roof deck insulation. But fire code restrictions have severely cut back the use of this material in these applications. The insulation board roof decking has also met with strong competition from perlite and rigid fiber glass boards for the same reason and because of better insulating characteristics. Until a fire-retardant insulation board ceiling tile is on the market and is widely accepted in building codes, fiberglass or mineral board substitutes will dominate the nonresidential market.

3. Price Elasticity of Demand

Changes in the price of insulation board from 1965 to 1976 have been moderate compared to those of lumber, plywood, and other wood products with which it competes (Table II-8). While the 1976 Wholesale Price Index (WPI) for insulation board products was 160.8 (1967=100), the WPI for all construction products had risen to 187.7. But the general inflation index was at 159.0; thus, insulation board prices have kept pace with general inflation and have experienced no real price increases. Several factors contribute to this situation.

First, improvements in plant efficiency and resulting lower costs may have allowed the industry to maintain its accepted level of profitability without increasing prices. However, given the recent history of wood costs, competition for fiber, and costs of finishing materials, this relationship is not likely to continue to be a major factor.

Second, the industry may have absorbed the impact of lower (but still positive) profit margins by increasing production volumes (and sales turnover) through the operation of additional shifts, and by making small incremental investments to increase existing plant capacities. The closure of six plants since 1960 while production continued to increase slightly is an indication that this has happened in the remaining plants. This could, depending on a facility's cost structure, result in level rates of return as a consequence of lower per unit costs on greater volumes.*

Finally, there is considerable competition between insulation board and other products. Insulation board may have been constrained by prices of substitute products such as gypsum. While there is probably some cross-elasticity of demand between insulation board and competing products, price is not the principal reason for utilizing insulation board. Restrictions on the use of insulation board by fire codes limit the total potential market. Thus the price elasticity of demand is probably inelastic; a 1% real price decrease will result in a unit sales increase of less than 1%.

4. Barriers to Entry of New Firms

At present, the most significant barrier to entry is market saturation and a declining market. Even if that were not the case, insulation board is capital intensive compared with the production of other solid wood products such as plywood and lumber. Other than capital requirements, the significant barriers are securing a wood source and, depending on the product line, the scale of the required marketing effort. Tile products would require a larger sales effort than sheathing because of the proprietary nature of the product. Thus, new firms would find it difficult to enter this business unless through acquisition of existing facilities.

5. Other Regulatory Factors

A result of a government timber policy restricting the harvest of Federal timber on the West Coast would be to push up prices of lumber and plywood. This would probably result in increasing demand for fiberboard and would allow substantial price increases. An easing of government timber policy that would allow a higher level of removals from West Coast forests, which is equally likely at this time, would have the opposite effect. However, insulation board would not be significantly affected by either policy.

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*Rate of return on capital is equal to margin on sales multiplied by sales turnover. If margin decreases and turnover increases, the rate of return could conceivably remain the same or even increase.

TABLE II-8

PRICE INDEXES FOR SELECTED INSULATION BOARD PRODUCTS[1], 1965-1978
(1967 = 100)

Year	All Construction Materials Price Index	1/2-Inch[2] Sheathing	Roof Insulation[3] Board	Ceiling Tile[4]	All Insulation Board	Percentage[5] Change Over Previous Year
1965	95.8	103.0	98.1	95.2	98.2	–
1966	98.8	101.2	100.2	96.0	98.4	0.2
1967	100.0	100.0	100.0	100.0	100.0	1.6
1968	105.6	106.0	98.7	105.2	103.0	3.0
1969	111.9	113.1	100.2	112.2	108.8	5.6
1970	112.5	102.5	103.3	118.5	110.5	1.6
1971	119.5	104.9	101.6	125.1	114.4	3.6
1972	126.6	116.8	101.8	128.7	119.0	3.9
1973	138.5	124.9	103.9	129.9	121.7	2.3
1974	160.9	136.7	130.1	134.3	133.9	10.0
1975	174.0	139.4	154.0	139.7	144.0	7.5
1976	187.7	161.9	165.8	149.5	161.0	11.8
1977	204.9	183.4	N/A	N/A	177.9	10.5
1978 (March)	221.9	207.9	N/A	N/A	196.8	10.6

1. F.o.b. mill, with freight allowed to destination.
2. Standard density, 1/2" x 2' x 8' to 4' x 9', with asphalt impregnation or water-resistant coating, manufacturer to wholesaler.
3. 1" x 2' x 4', asphalt treated, manufacturer to roofing contractor.
4. 1/2" x 1' x 1', 1 x 2', or 1 x 3', factory-painted plain surface, beveled edges, manufacturer to wholesaler or retailer.
5. Changes in composite index for all insulation board products.

Source: U.S. Bureau of Labor Statistics.

G. FINANCIAL PROFILE

Plant sales vary directly with production. However, plant book values differ for plants of similar size because of plant age and other factors.

The median value of the cost of goods sold is 84% for insulation board manufacturers. There is a substantial variability in cost structure among plants in the industry and the profit before tax ranged from a loss to 13% of sales in 1976 (Table II-9).

TABLE II-9

FINANCIAL PROFILES

PRO-FORMA INCOME STATEMENT INSULATION BOARD PLANTS

Sales (1976)	$8,500,000 (range $3-30 million)
Capacity	125 million square feet
Capacity Base	1/2"

Pro-Forma Cost of Manufacture	Median Value (%)	Range of Values (%)
Sales	100	100
Cost of Goods Sold		
Labor	25	15-31
Materials	35	30-50
Depreciation	4	2-8
Other Expenses	20	2-44
Total Cost of Goods Sold	84	76-92
Gross Margin	16	8-24
Selling General & Administrative	10	7-18
Interest	–	–
Profit Before Tax	6	< 0-13
Profit After Tax	3	< 0-7
Plant Book Value	$7,000,000	$500,000-$25,000,000

Source: EPA Financial Survey. Excludes plants producing both insulation board and hardboard.

While the distribution of manufacturing cost differs somewhat by size of plant, there appear to be significant differences in relative costs due to other factors. A number of insulation board plants appear to have been operated at a loss in 1976, and overall operating margins were small compared with those of hardboard plants. The outlook for insulation board demand indicates that the financial condition of some insulation board plants will worsen as capacity utilization rates fall. In the face of falling demand, insulation board plants are also likely to shut down or convert to other products.

III. INDUSTRY CHARACTERIZATION — WET PROCESS HARDBOARD

A. INDUSTRY DEFINITION

Wet process mills are only one segment of the hardboard production capacity. The industry* is composed of three segments: wet, wet-dry and dry processes, that serve the same markets with similar products and are largely operated by the same companies. Inherent differences in physical product characteristics developed by each process, however, make each product better suited to some applications.

The wet process hardboard industry comprises establishments producing hardboard in densities generally between 31 and 65 pounds per cubic foot from inter-felted wood fiber using a wet forming and either a wet or dry pressing process (known respectively as wet-wet and wet-dry). The dry process segment of the industry uses a dry forming and dry pressing process to manufacture hardboard, as described in the Technical Document.

B. TYPES OF FIRMS

1. Size of Firm

There are 15 producers operating 28 wet and dry process plants (Table III-1). The industry is composed of twelve large corporations and three private firms. Seven of the 15 hardboard producers operate more than one hardboard plant. Wet process plants represent 16 of the 28 facilities and are operated by 11 producers, four of which operate more than one wet process plant.

On the basis of 1977 capacity, the larger corporations in the wet process board industry are Masonite, Abitibi, Champion International, Weyerhaeuser, and U.S. Gypsum. The largest private company, Superwood, is the fourth-ranked producer in the industry whereas the other two, Forest Fiber and Superior Fiber, are among the smallest producers.

Total annual sales for companies in the wet process segment of the hardboard industry, including sales from other operations, such as lumber, plywood, paper, and chemicals, range from $25 million to more than $3.6 billion (Table III-2). Hardboard sales as a percent of total sales varies from one firm to another.

2. Ownership/Integration/Product Diversification

Of the 17 wet and wet-dry process hardboard mills, 13 are owned by publicly held corporations; the 4 remaining mills are owned by 3 private companies.

Frequently, the public corporations' own woodlands can supply 35-45% of their raw material needs. Privately held forest products companies are also likely to own some woodlands, but they do not typically derive as large a percentage of their wood requirements from these sources.

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* Standard Industrial Classification 2499, "Wood Products Not Elsewhere Classified," includes, among other industries, medium-density fiberboard, wet process hardboard, and dry process hardboard. SIC data do not distinguish among these three industries.

TABLE III-1

HARDBOARD PRODUCTION CAPACITY, 1977
(million square feet – 1/8" basis)

WET-WET PLANTS[1]

Company	Location	Annual Capacity
Abitibi[2]	Alpena, MI	200
Abitibi	Roaring River, NC	315
Evans Products	Corvallis, OR	110
Forest Fiber	Forest Grove, OR	114
Masonite	Laurel, MS	1850
Masonite	Ukiah, CA	560
Superior Fiber	Superior, WI	158
Superwood	Duluth, MN	380
Superwood	N. Little Rock, AK	130
Champion International	Dee, OR	76
	Subtotal	3893

WET-DRY PLANTS

Abitibi[2]	Alpena, MI	329
Boise Cascade	International Falls, MN	700
Temple	Diboll, TX	244
Weyerhaeuser	Craig, OK	175
U.S. Gypsum	Danville, VA	230
U.S. Gypsum	Pilot Rock, OR	86
U.S. Gypsum	Greenville, MS	155
	Subtotal	1919
	Total – Wet Process	5812

DRY PLANTS[3]

Boise Cascade	Phillips, WI	80
Celotex	Paris, TN	195
Champion International	Catawba, SC	225
Champion International	Lebanon, OR	107
Georgia Pacific	Conway, NC	265
Georgia Pacific	Coos Bay, OR	201
Louisiana Pacific	Oroville, CA	150
Masonite	Towanda, PA	490
Publishers Forest Prods.	Anacortes, WA	52
Superwood	Bemidji, MN	90
Weyerhaeuser	Doswell, VA	315
Weyerhaeuser	Klamath Falls, OR	290
	Total Dry Process Capacity	2460
	Total Hardboard Capacity[4]	8272

1. The Masonite mills and the Abitibi mill in Alpena, MI, use combinations of the wet-wet and wet-dry processes.
2. There are wet-wet and wet-dry operations at this location.
3. Does not include medium-density fiberboard (MDF) plants because MDF is a different product used in different applications.
4. Georgia Pacific opened a hardboard line in Jarratt, VA, in 1978, with an annual capacity of 231 million square feet, 1/8" basis.

Sources: 1976 *Directory of the Forest Products Industry,* American Board Products Association, and Arthur D. Little, Inc., estimates.

TABLE III-2

HARDBOARD SALES, 1977
(all producers, $MM)

Company	Total Corporate Sales[1]	Total Hardboard Sales[2]	Wet Process Hardboard Sales[2]
Abitibi Paper Co. Ltd.	800	72	72
Boise Cascade	2316	66	60
Celotex/Jim Walter[1]	525/1422	17	–
Champion International	3127	34	7
Evans Products	941	9	9
Forest Fiber	N/A**	9	9
Georgia Pacific	3675	40	–
Louisiana Pacific	794	13	–
Masonite*	445	247	206
Publishers/Times Mirror Co.	NA/976	5	–
Superior Fiber/Carlson Companies	NA/650	13	13
Superwood	N/A	N/A	44
Temple/Time Inc.	340/1038	21	21
U.S. Gypsum	1177	40	40
Weyerhaeuser	3283	66	15

*Fiscal year ends August 31.
**Not available.

Sources:
1. Dun and Bradstreet Directory, 1978, Directory of Corporate Affiliations, 1978.
2. Arthur D. Little, Inc., estimates, based upon an operating rate of 100% and the prices for 1977 shown in Table III-9.

Arthur D. Little staff members are of the opinion that this is the case for the privately held wet process hardboard plants.

Six of the parent companies operate captive distribution systems that handle a portion of their output. The remaining producers sell their products through independent wholesalers or through the captive distribution systems of other companies.

In addition to hardboard products, all of the parent companies are involved in the production and distribution of a wide range of other competing and non-competing wood products and various building materials. Eight hardboard plants are parts of forest products complexes that may produce various combinations of lumber, plywood, particleboard, fiberboard, pulp, and/or paper. The parent companies generally have a strong orientation towards forest products (five are

involved in the paper industry) and may produce other building materials such as gypsum board. Three of the firms are significantly diversified beyond building materials businesses: Evans into the manufacture of railroad cars, Champion and Abitibi into paper production.

C. PRODUCT DESCRIPTION

1. Types of Hardboard Products

Hardboard products can be divided into four classes on the basis of water resistance, modulus of rupture,* and tensile strength.** The four classes, listed in order of decreasing strength properties, are as follows:

(1) tempered
(2) standard
(3) service-tempered
(4) service

Hardboard products serve four general markets: interior paneling, exterior siding, industrial and do-it-yourself. Most of the mills have associated fabricating facilities for prefinished paneling, panel stock, siding, perforated board, embossed, and/or cut-to-size products.

Hardboard serves a very wide range of end uses involving about 800 different sets of specifications. Marketing efforts have usually been aimed at displacing traditional products such as gypsum, plaster, stucco, and plywood in specific applications. Hardboard is challenging and being challenged by these products and others in various markets and applications.

Interior paneling may be manufactured from any of the four classes of hardboard in thicknesses of ⅛ to ¼ inch. Panels up to 5 feet wide or 12 feet long are available. Hardboard was used as the substrate in about 20% to 40% of the interior paneling sold in 1973, with its major competition being inexpensive Lauan plywood, domestic hardwood plywood, and thin particleboard. It is used for both wood-grain prints and tileboard panels. The surface of the panel may be embossed to provide a surface texture or pattern before a finish is applied. The hardboard manufacturer may produce and sell prefinished paneling, unfinished paneling stock, or both.

Siding is manufactured specifically for exterior use. Lap siding (i.e., narrow boards that are overlapped in use) is manufactured in thicknesses of ⅜ inch and greater, widths from 4 to 12 inches, and lengths up to 16 feet in two-foot increments. Panel siding is fabricated in sheets 4 feet wide, 4 to 12 feet long and usually ¼ inch thick or thicker. Hardboard was introduced to the siding market in the late 1940's and now competes against polyvinyl chloride (PVC), aluminum, brick, stucco, plywood, and other wood siding materials.Textures simulating most other siding materials, as well as improved finishes, have increased hardboard's market share in residential siding. Hardboard siding is now also gaining market share in mobile home applications and Arthur D. Little expects this trend to continue because manufacturers wish to replace aluminum with conventional residential materials wherever possible.

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* Modulus of rupture: the measure of the force necessary to break the board.
** Tensile strength: resistance to lengthwise stress, measured by the greatest load in weight per unit area, pulling in the direction of length, that the board can bear without tearing apart.

The industrial market for hardboard encompasses a very wide range of end-user and OEM (original equipment manufacturer) applications, including: displays, furniture, transportation, electronics, interior construction, factory equipment, and toys. The list of actual and possible uses is extremely diversified. Most industrial markets require the hardboard manufacturer to meet a unique set of specifications pertaining to board characteristics and/or fabrication requirements. The industrial market is so diversified that competition from substitute products in any one segment has only minimal effect on the overall hardboard industry. However, companies that concentrate on only a few markets can be affected.

2. Market Size and Future Growth

Economic trends from 1975 to 1979 were generally favorable to the industry (Table III-3). In 1978, shipments from domestic plants totalled 7.8 billion square feet, reflecting an average annual growth rate of 7.9% since 1964. The industry slowdown in 1974 and 1975 was followed by a strong recovery in 1976 that continued into 1979.

TABLE III-3

SHIPMENTS, IMPORTS, AND APPARENT CONSUMPTION, 1964-1978
(million square feet – 1/8" basis)

	U.S. Shipments	Imports	Apparent Consumption	Imports as a % of Consumption
1964	2689	471	3160	14.9
1965	2921	572	3493	16.4
1966	3083	443	3526	12.6
1967	3038	426	3464	12.3
1968	3710	648	4358	14.9
1969	4247	708	4955	14.3
1970	4384	457	4841	9.4
1971	5225	634	5859	10.8
1972	5798	1070	6868	15.6
1973	6050	1039	7089	14.7
1974	5654	750	6404	11.7
1975	5681	277	5958	4.6
1976	6485	494	6979	7.1
1977	7714	627	8341	7.5
1978	7843	920	8763	10.5

Source: American Board Products Association.

Reliable data on exports are unavailable but exports are believed to be less than 2% of domestic production. In contrast, in 1968, imports of hardboard reached 16.4% of domestic consumption. Although producers in developing countries generally enjoy lower costs and no entry duties, imports are very sensitive to economic conditions in the United States. Imports suffered a severe market share setback in 1975-1976 due to the generally weak housing/construction market; and are only beginning to recover; in 1978, imports were only 4.6% of consumption (Table III-3). Hardboard imports appear to be generally adequate to satisfy the lower quality end of the hardboard market. Arthur D. Little staff members believe that U.S. domestic producers are frequently the purchasers of foreign hardboard to satisfy domestic demand during periods of rapid demand growth. Industry sources indicate that at those times domestic suppliers generally prefer to upgrade the quality of product they supply in order to improve average margins.

Brazil (34% of 1978 imports) is by far the largest source of hardboard imported by the United States; the U.S.S.R. (19%) and Romania (8%) are also significant, with Poland, Sweden, Canada and a few other countries selling hardboard in U.S. markets in varying quantities. Brazil, Argentina, Romania and Korea are among the developing countries that do not face U.S. tariffs now. Most other countries, except the U.S.S.R. (30%), pay a 7.5% *ad valorem* duty for imports into the United States. The United States will remain a net importer of hardboard, despite the declining trend in imports, because of the industry practice in tight markets of supplementing domestic supply with imports.

Capacity utilization declined significantly in 1972 because of a 30% increase in capacity in that year, and again in 1974/1975 as a result of unfavorable market conditions and a conversion of insulation board capacity to hardboard production (Table III-4). In 1976, demand strengthened and the industry has operated at higher than historic levels in 1977 and 1978.

Historically, losses in one market have been offset to a greater or lesser extent by gains in another. For example, hardboard continues to lose automotive markets because the technological trend toward light automobiles has resulted in the use of lightweight plastics in applications where hardboard was formerly dominant. On the other hand, the minimal quantities of petrochemical adhesives and relatively low energy intensity required in hardboard manufacture protect the industry from a potentially severe impact of increased resin costs. Increases in the cost of plastics and of other siding products such as brick have helped to stimulate demand for hardboard siding.

Roughly 60% of hardboard is used directly in construction or is affected by construction demand, while most of the remainder is used in industrial applications. Shipments of hardboard follow the construction industry trends but because of its industrial market the hardboard industry's shipments have been less volatile than those of the construction industry (Figure III-1). Analysis of 1964-1978 shipments and consumption using a least squares linear-time trend results in annual growth rates of 7.9% and 7.4% respectively. Based upon data in Table III-4, growth rates in the 1972-1978 period for shipments and consumption were 5.2% and 4.2%, respectively, because of an industry slowdown in 1974 and 1975. The slower growth rates for consumption are a result of fluctuations in the level of imports.

The consumption growth rates indicate that hardboard's share of the construction materials market has increased. The economy in general experienced a growth rate of about 3.0% per year for the period, and construction since 1973 has remained below 1973 constant dollar levels. This

TABLE III-4

CAPACITY UTILIZATION BY HARDBOARD INDUSTRY, 1967-1978
(million square feet – 1/8" basis)

	Annual Capacity	U.S. Shipments	Capacity Utilization (%)
1967	4555	3038	67
1968	4648	3710	80
1969	5019	4247	85
1970	5335	4384	82
1971	6000	5225	87
1972	7753	5798	75
1973	7916	6050	76
1974	8723	5654	65
1975	8348	5681	68
1976	7771	6485	83
1977	8272	7714	93
1978	8284	7843	95

Source: American Board Product Association.

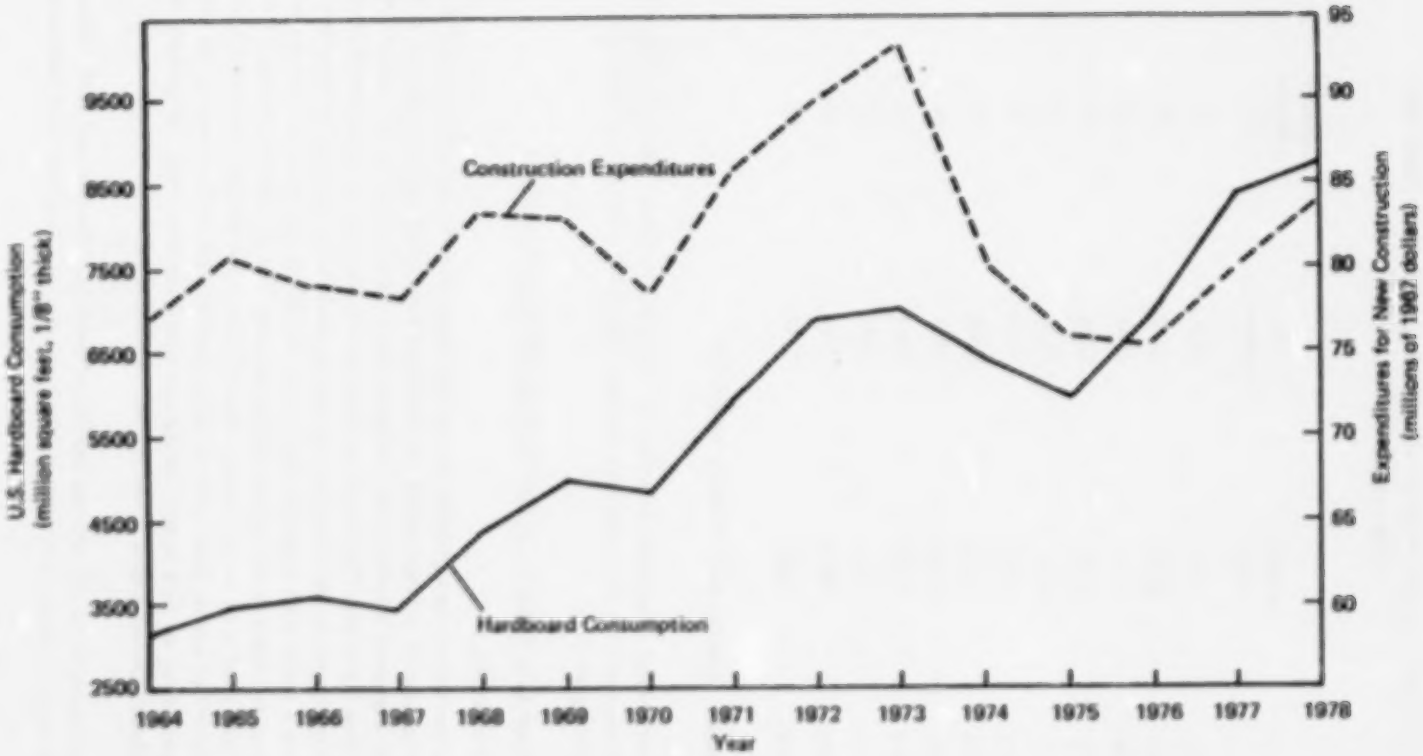
market share growth trend is forecast by Arthur D. Little to continue, and long-term growth in consumption will average up to 2.0% annually through 1984, with short-term trends following the construction cycle (Figure III-2).

D. PLANT CHARACTERISTICS OF THE EXISTING INDUSTRY

1. Process Technology

Wet process operations use a pulping process that requires large amounts of water and a wet mat forming system similar in some respects to the fourdrinier paper forming process. In wet-wet mills, the wet mat is pressed between a flat hot platen and a rigid screen that will allow steam and water to escape from the board. The board produced in this manner is called a smooth-one-side (S1S) or screen-back board. In wet-dry mills, the mat is dried before pressing between two flat hot platens, producing a board with a smooth surface on both sides (S2S). In dry process mills, the mat is formed from dry fibers in an air inter-felting process. The dry mat is pressed between two flat hot platens, thus producing an S2S board. One mill uses a dry-wet process in which the mat is dry-formed, as described above, then water is added and it is pressed between a flat hot platen and a screen, producing an S1S board. Insulation board capacity may, in certain cases, be converted to produce selected grades of wet process hardboard (and vice versa).

Process developments in wet process hardboard have been limited and slow, although the industry has had major product developments such as exterior siding and deep embossing. As a



Source: U.S. Department of Commerce, American Board Products Association.

FIGURE III–1 HARDBOARD CONSUMPTION AND CONSTRUCTION EXPENDITURES, 1964–1978

Source: Arthur D. Little, Inc., forecasts.

FIGURE III–2 TOTAL HARDBOARD DEMAND, 1976–1984

result of design changes in caul (press) plates used in wet pressing operations, wet-wet mills can produce an S2S hardboard with minimal sanding, allowing them to compete in S2S markets against wet-dry and dry-dry mills.

There are no foreseeable technical process developments that will have a major effect on the hardboard industry. The technology of the wet process hardboard industry generally has remained static since the development of dry process mills in 1952 eliminated many of the water pollution problems facing the industry. Dry process technology is competitive with the wet process mills to the extent that it makes possible the manufacture of some competitive hardboard grades without incurring water pollution abatement costs. This advantage is partially offset by air pollution control expenditures that will be required for dry process mills. It is, of course, theoretically possible to convert a wet process mill to a dry process mill; however, the capital costs involved would make the operation both uneconomical and uncompetitive; thus, conversion to dry processes is an unlikely response to revised effluent regulations.

2. Size/Age/Location

A typical wet process plant produces 230 million square feet (MMSF-⅛ inch) annually; individual plant capacities range from 52 to 1850 MMSF (Table III-1). Although the largest plant is also the oldest (Masonite started operations in Laurel, Mississippi, in 1926), the older plants tend to be smaller.

Prior to 1948, only three hardboard plants were in operation in the United States and all used a wet process (Table III-5). Of the ten plants built in the 1948-1957 period, five were wet process mills. The next decade brought six wet and four dry process mills. Since 1968, two wet process mills have been built (both in 1971) while three dry process mills have started production. Prior to 1978 there were sixteen wet process mills (including seven wet-wet, six wet-dry, and three operations using both processes) and twelve dry process mills in the United States. A thirteenth dry-process mill was due to start up late in 1978. Additions to existing mills did not necessarily use the same process; three mills are actually a combination of wet forming and both dry and wet press lines. This gives these mills additional flexibility to meet market demands by producing either S1S or S2S hardboard. Most of the older plants have been continually expanded and modernized; thus age is not a valid indication of efficiency.

The first two plants were constructed in Mississippi and used roundwood as their fiber source. Later, expansion of the industry in the North Central states depended on inexpensive hardwoods, while mills in the Pacific states used wastes from softwood lumber and plywood operations as fiber sources. The fact that hardboard mills are evenly spread throughout these regions is indicative of the wide range of wood species being used in hardboard. Most of the plants are located on rural sites but several are in urban and suburban areas.

3. Employment

Most plants employ between 100 and 400 workers and staff. Employment figures (Table III-6) for each mill depend upon the size and product mix of the facility, but especially on the efficiency of various product transfer steps throughout the process, the mill layout and warehousing functions.

TABLE III-5

DISTRIBUTION OF
HARDBOARD PLANTS BY PLANT AGE

Year of Start-Up	Number of Plants	
	Wet[1]	Dry[2]
Prior to 1948	3	0
1948-1957	5	5
1958 to 1967	6	4
1968 to 1977	2	3
Total	16	12

Sources: 1. EPA Financial Survey. Does not include Jarratt, Va.
2. Industry data.

TABLE III-6

EMPLOYMENT IN
WET PROCESS HARDBOARD PLANTS

Number of Employees	Number of Plants
0-199	8
200-399	5
400+	3
Total	16

Source: EPA Financial Survey

E. CHARACTERISTICS OF NEW CAPACITY

1. Recent Capacity Additions

No new wet hardboard plants have come on-stream since 1971; however, several locations have added substantial capacity. In addition to large capacity expansions in 1972, Masonite completed a 175-MMSF expansion of its wet process plant in Ukiah, California, in 1977. Abitibi also completed small expansions of the Alpena and Roaring River facilities. The 100-MMSF addition to the Weyerhaeuser plant in Doswell, Virginia, was the only dry process expansion. Boise Cascade diverted some of the insulation board capacity at International Falls, Minnesota, to add 100 MMSF to its hardboard capacity. At least five of the plants in the industry have also added incremental volumes to their siding production capacity.

Announced plans for capacity additions in 1979 include construction of a 66-MMSF, 7/16-inch, wet process hardboard siding mill at Georgia Pacific's insulation board plant in Jarratt, Virginia. Temple Industries also has announced a $21 million addition to its wet process facility to produce hardboard siding. No further information has been made public about these projects or any others.

2. Process Economics of New Capacity

A process economics model for a greenfield mill indicates that this facility requires a price of $141/MSF; this price level is 79% higher than the 1978 price and higher than any real price level likely to occur by 1982 (Table III-7). Therefore, it is extremely unlikely that anyone would build a wet process S2S mill. Capacity addition would most likely take the form of incremental expansion of existing facilities or perhaps the conversion of insulation board capacity.

TABLE III-7

PROCESS ECONOMICS OF NEW WET PROCESS HARDBOARD CAPACITY
($ 1978)

	S1S Greenfield Mill	Conversion of Insulation Board Mill	Incremental Expansion
Design Production (MMSF, 1/8")	293	234	117
Capital Investment ($ million)	50	25-28	15-20
Operating Cost ($ million)			
Labor	10.2	9.0	3.7
Wood	4.2	3.4	1.7
Other Materials	4.2	3.4	1.7
Energy	3.6	3.2	1.3
Other Costs	2.0	1.6	0.8
	24.2	20.6	9.2
Operating Cost/MSF, 1/8" ($)	82.59	88.03	78.63
Investment/MSF, 1/8" ($)	170.65	113.70	149.57
Price to Support New Capacity per MSF, 1/8" ($)	141.00	125.00	114.00

Source: Arthur D. Little, Inc., estimates. See Appendix A, Table A-2 for assumptions on underlying costs.

The parameters of any expansion or conversion are extremely variable and unique to every case. Thus the capital investment and the operating cost for each of the wet process hardboard expansion methods shown in Table III-7 are not applicable to any specific situation. Incremental operating costs per thousand square feet, 1/8" basis, are lowest for capacity added through incremental expansion, followed by that for a greenfield mill and insulation board plant conversion. Investment costs per thousand square feet are highest for a greenfield plant and lowest for an insulation board plant conversion.

F. COMPETITIVE STRUCTURE

1. Market Structure

The five largest firms control 70.5% of the total hardboard production capacity. Masonite Corporation, by far the largest firm in the industry, controls 35.1% of the total hardboard capacity and 41.5% of the wet process hardboard capacity (Table III-8). Wet process mills represent 70.3% of the total U.S. hardboard capacity (Table III-1).

TABLE III-8

HARDBOARD INDUSTRY CAPACITY, 1977

Firm	Percent of Total Capacity	Wet Process	
		Percent of Capacity	Percent of Firm's Hardboard Capacity
Masonite	35.1	41.5	83.1
Abitibi	10.2	14.5	100.0
Weyerhaeuser	9.4	3.0	22.4
Boise Cascade	8.5	12.0	89.7
Superwood	7.3	8.8	85.0
U.S. Gypsum	5.7	8.1	100.0
Champion	4.9	1.3	18.6
Temple	2.9	4.2	100.0
Superior Fiber	1.9	2.7	100.0
Evans	1.3	1.9	100.0
Forest Fiber	1.4	2.0	100.0
Total	88.6*	100.0	81.7**

*Four other firms are operating only dry process mills.
**Average

Source: American Board Products Association.

2. Pricing Mechanism

The ability of the industry to pass increases in production costs for tempered hardboard on to the marketplace is of major importance in considering the question of whether or not hardboard producers will be able to continue operations with additional costs for pollution control.

Prices are quoted on the basis of dollars per thousand square feet and are usually based on standard units and sizes. Prices are generally f.o.b. mill with full rail freight allowed to the destination. Because of the wide range of end uses, prices, and customer categories, hardboard prices are set at a number of levels, depending on the class of trade of the purchaser. Frequently, specific hardboard prices involve a complicated schedule of discounts and extras, dependent upon the size of the load, packaging, style of the product, degree of fabrication, quality, etc.

The largest producer has been a market leader in product design trends, frequency of price changes, and price leadership. As explained earlier, the industry serves a very wide range of end uses requiring an estimated 800 different sets of specifications, which makes direct competition between manufacturers selling to the industrial market more difficult. Hardboard marketing efforts traditionally have been aimed at displacing such entrenched products as lumber and plywood in specific applications using price as an incentive. Hardboard is now challenging and being challenged by plastics and metals for various applications. Consequently, a major pricing factor is the possibility of substitution of competitive materials by and for hardboard. Price competition can be a marketing tool in sales to retail yards handling large volumes of hardboard and other construction materials.

3. Price Elasticity of Demand

Price changes in hardboard from 1967 to 1976 (Table III-9) have been far less frequent and quite moderate compared with price changes of other construction materials with which it competes. While the wholesale price index for construction materials in 1976 was 187.7, the wholesale price index for tempered hardboard was only 131.4. Furthermore, the GNP deflator for 1976 was 1.59 of the 1967 level, which shows that hardboard prices have failed to keep pace with general economic conditions. Several factors contribute to this situation.

First, costs of production have not increased as rapidly as general inflation, which may have allowed the industry to maintain its accepted level of profitability without increasing prices. This situation will probably not continue given the likely real increases in wood costs and increased competition for fiber generally expected by forest products companies.

Second, the incremental additions in 1976, 1977 and 1978 suggest that the industry may have absorbed the anticipated effect of lower (but positive) margins per unit by adding shifts. This course of action would result in higher sales turnover and may have stabilized return on capital.*

Finally, there is considerable competition between hardboard and other construction products. Hardboard producers may have to keep their prices down to meet competition from substitute products and maintain market shares. Price has varied somewhat independently of consumption in the past and in different magnitudes, as shown in the random pattern of price-consumption correlations (Table III-9). The escalation in wood prices expected by the forest products industry in the 1980's will affect substitute products like plywood more than hardboard, and the price of hardboard will rise as will the price of substitutes.

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* Rate of return on capital is equal to margin on sales multiplied by sales turnover. If margin decreases and turnover increases, the rate of return could conceivably remain the same or even increase.

TABLE III-9

TEMPERED HARDBOARD PRICE TRENDS, 1963-1978

Year	Price[1]	Percent Increase Over Previous Year	Price[2] Index	All Construction Materials Price Index
1963	61.956	–	103.8	93.6
1964	61.001	1.6	102.2	94.7
1965	60.941	0.1	102.1	95.8
1966	60.822	(.2)	101.9	98.8
1967	59.688	(1.9)	100.0	100.0
1968	58.633	(1.8)	98.3	105.6
1969	59.969	2.3	99.8	111.9
1970	61.001	1.7	102.2	112.5
1971	60.345	(1.1)	101.1	119.5
1972	61.001	1.1	102.2	126.6
1973	62.792	2.9	105.2	138.5
1974	70.432	12.5	118.0	160.9
1975	70.253	0.3	117.0	174.0
1976	78.430	11.6	131.4	187.7
1977	85.175	8.6	142.7	204.9
1978	93.95	10.3	157.4	228.2

1. Manufacturers' price to jobber or wholesaler delivered to destination or f.o.b. mill with freight allowed, $/MSF, 1/8" basis.
2. 1967 = 100

Source: U.S. Department of Labor, Bureau of Labor Statistics, *Wholesale Price Indices.*

The ability of hardboard manufacturers to pass on the additional costs of pollution abatement depends on the relative cost increase. Any increase in costs will result in higher levels of competition from substitute products and a more cautious approach to the commitment of capital for capacity expansions. Arthur D. Little staff members are of the opinion that decreases in market share, if they occur, would be slow in industrial markets because end-use products would have to be redesigned to accommodate substitutes. In contrast, decreases would occur more rapidly in most construction applications as hardboard is used in its standard form and price competition from substitutes is more prevalent.

A price scenario for wet process hardboard was developed to gauge the ability of hardboard producers to recover higher costs through higher prices. The demand forecast through 1984 was combined with announced capacity expansion commitments and an Arthur D. Little forecast of additional capacity that might be added in 1982 through 1984 (Table III-10). Estimates of potential real price increases were based upon the estimated operating rate of U.S. plants and the volume of imports necessary to satisfy U.S. demand. Current price levels and the high rate of overall inflation indicate that producers will suffer a real price decline in 1979 of 6% and that they will not fully recover until 1981. By 1984, real price increases on the order of 20% are likely, most of the increase occurring in 1984.

TABLE III-10

HARDBOARD DEMAND AND PRICE FORECAST, 1978-1984

	U.S. Capacity	U.S. Shipments	Operating Rate	Imports	MMF[2] 1/8" Apparent Consumption	% Change In Real Price MSF, 1/8"
1978	8284	7843	95	920	8763	2
1979	8340	7692	92	627	8319	-6
1980	8760	8322	95	478	8800	2
1981	8935	8666	97	533	9200	6
1982	8935	8455	95	445	8900	2
1983	8955	8686	97	694	9380	6
1984	8975	8705	97	1094	9800	10

Source: Arthur D. Little, Inc., forecast based upon methodology described in Section C.

4. Barriers to Entry of New Firms

The most significant barrier to entry is that the price required to provide a risk commensurate with a return on a new plant investment must be 79% higher than the 1976 market price. Compared to other solid wood products mills, hardboard is a capital-intensive industry and the cost of a new facility is two or three times higher than for a plywood mill.* Other barriers to the entry of new firms, however, are ownership of distribution channels, and the development of a secure fiber source. A new company would have to develop new markets or "buy" market share from competitors through price competition. Given the small number of the existing producers and market concentration, it could be a costly and difficult task at best.** A new producer has the alternative of selling through the existing producers' distribution systems, as is done in the case of other wood products, but this would be undesirable for both production and marketing reasons.

5. Other Regulatory Factors

A result of government policy restricting the cut of Federal timber on the West Coast will be to push prices of lumber and plywood upward, thereby relieving some pressure against hardboard price increases. An easing of government timber policy that would allow a higher level of removals from West Coast forests, which is equally likely, would have the opposite effect.

G. FINANCIAL PROFILE

While wet process hardboard sales vary directly with production, plant book values will differ for plants of similar size, primarily because of age of plant.

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* Arthur D. Little, Inc., estimates.

** The four firms have 60% of total industry capacity, indicating a somewhat oligopolistic market. In such markets, price cutting by one firm usually would be matched by others and not provide much opportunity for increasing share. See Richard Caves, *American Industry Structure, Conduct, Performance*, Prentice Hall.

There was no observable difference among the Financial Survey respondents in the distribution of the pro-forma costs of production for wet process hardboard (Table III-11) between plants that may be required to undertake expenditures for water pollution regulations and plants that are currently in compliance. Differences in the distribution of costs arise in part from plant size differences and plant location (local cost) factors.

TABLE III-11

PRO-FORMA INCOME STATEMENT
WET PROCESS HARDBOARD PLANTS

1976 Sales	$16,000,000 (range $6,000,000 –>$120,000,000)	
1976 Capacity	200 Million square feet	
Capacity Base	1/8"	
Pro-Forma Cost of Manufacture	**Median Value**	**Range**
Sales	100%	100%
Cost of Goods Sold		
Labor	20	15-50
Materials	30	19-50
Depreciation	5	2-5
Other Expenses	20	5-28
Total Cost of Goods Sold	75	
Gross Margin	25	15-36
Selling, General & Administrative	11	7-25
Interest		0-4
Profit Before Tax	14	8-24
Profit After Tax	7	1-13
Plant Book Value $	10,000,000	900,000 >$40,000,000

Source: Derived from the EPA Financial Survey.

IV. COST OF COMPLIANCE WITH REVISED WATER EFFLUENT REGULATIONS

A. INTRODUCTION

The purpose of this chapter is to describe the current water effluent method of disposal used by affected insulation board and wet process hardboard plants, and to summarize the cost of compliance developed by the Technical Contractor. These data were used to estimate the economic impact of the revised water effluent regulations (described in Chapter V). Also described are the pollution control options for new sources and their associated costs of compliance.

Two control options for existing plants were examined: Option 1 — Best Practical Technology (BPT); Option 2 — Best Conventional Technology (BCT).

B. CURRENT EFFLUENT STATUS

Plants producing both insulation board and wet process hardboard are classified according to the predominant product volume and are referred to throughout as "combination" plants.

Of the ten wet and one wet-dry process hardboard-only plants, nine discharge into navigable water, one discharges into municipal sewers and one recycles its process wastewater (Table IV-1). The insulation board-only plants will not be required to install additional pollution-control equipment under either of the studied options. Of the five combination plants, three discharge into navigable water, one into a municipal sewer and one has no discharge.

TABLE IV-1

INSULATION BOARD AND WET-DRY AND WET PROCESS HARDBOARD CURRENT METHOD OF WATER EFFLUENT DISPOSAL

	Insulation Board Only		Wet-Dry and Wet Process Hardboard Only*		Wet-Dry Process Hardboard/Insulation Board Combination	
Current Water Effluent Disposal	Number of Plants	% Total	Number of Plants	% Total	Number of Plants	% Total
Navigable Water	2	18	9	66	3	60
Municipal Sewer	5	45	1	17	1	20
No-Discharge	4	37	1	17	1	20
Total	11	100	11	100	5	100

*Counting Abitibi's Alpena, Michigan operation as one plant.

Source: U.S. Environmental Protection Agency.

C. POLLUTION CONTROL OPTIONS FOR EXISTING PLANTS

1. Cost Models

Many plants have pollution control equipment in place and their current treatment will be sufficient for several of them to meet revised effluent guidelines. However, three wet process

hardboard plants would be required to install pollution control equipment under Option 1 (BPT) and four more plants (seven total) would be required to install new equipment to meet revised water effluent regulations under Option 2 (BCT).

Since so few plants in the wet process hardboard sector need to undertake compliance activities, the Technical Contractor generated costs of compliance for each affected plant. The cost estimation method was to use one or more of the plants currently in compliance with Option 1 and/or Option 2 as model treatment processes. The cost of installing that model treatment process was then estimated separately for each affected plant. Table IV-2 depicts the relationship between the pollution control options and model treatment plants.

TABLE IV-2

MODEL PLANT TREATMENT OPTIONS

Affected Plant	Model Treatment Plant	Current Discharge Method	Proposed Discharge Method
Wet Process Hardboard			
Option 1 – S1S/S2S	2099		
Option 2 – S1S	2006		
Option 2 – S2S	2010		
Plant 2001		Direct	Direct
Plant 2002		Direct	Direct
Plant 2003		Direct	Direct
Plant 2004		Direct	Direct
Plant 2007		Direct	Direct
Plant 2012		Direct	Direct
Plant 2099		Direct	Direct

Source: Environmental Science and Engineering, Inc.

The wet process hardboard control options represent different degrees of stringency. Option 1 calls for a screen, a first settling basin, an aerated lagoon, and a second settling basin. Option 2, for S1S, consists of two consecutive aerated lagoons followed by a settling basin. Option 2, for S2S, consists of a screen, an equalization basin, a primary clarifier, activated sludge removal, a secondary clarifier, an aerated lagoon and a facultative lagoon; in addition, prior to disposal the sludge is processed through an aerobic digester, a sludge thickener and a vacuum filter.

2. Costs of Compliance

The differences among the control option costs for wet process hardboard plants are significant, apparently because of differences in the size of facilities.* The control costs for each option (Table IV-3) represent the cost for that plant to modify its existing water pollution treatment system to achieve the level of control specified by that option, based upon the plant's current level of control. Under the less stringent EPA option, three plants (2002, 2003 and 2004) would be affected. Under Option 2, four plants would be added to the list of affected plants.

*(See 1976 revenue in Table V-1.)

TABLE IV-3

COST OF COMPLIANCE FOR PLANTS AFFECTED BY REVISED EFFLUENT REGULATIONS (1977 $000)

Option 1 (BPT)	Type of Product	Investment			Operating Costs[1]	Acres of Land	Annualized Cost
		Total	Land	Other Investment			
Plant 2002	S1S	285	5	280	51	.5	117
Plant 2003	S2S	7,266	40	7,226	2,215	4.0	3,437
Plant 2004	S1S	2,005	159	1,846	292	15.9	653
Total Option 1		9,556	204	9,352	2,558		4,207
Option 2 (BCT)							
Plant 2001	S1S	6,856	188	6,668	796	18.8	1,942
Plant 2002	S1S	1,105	46	1,059	107	4.6	361
Plant 2003	S2S	7,436	40	7,396	2,300	4.0	3,550
Plant 2004	S1S	2,938	300	2,638	394	30.0	920
Plant 2007	S1S	183	–	183	101	0	128
Plant 2012	S1S	599	–	599	103	0	241
Plant 2099	S1S	1,228	30	1,198	107	3.0	331
Total Option 2		20,345	604	19,741	3,908		7,473

1. Excludes capital recovery cost.

Sources: References 1 and 2, Environmental Science and Engineering, Inc., the U.S. Environmental Protection Agency, and Arthur D. Little, Inc., estimates. See Appendix C for a discussion of the methodology used to calculate annualized costs.

D. POLLUTION CONTROL OPTIONS FOR NEW SOURCES

1. Cost Models

A candidate new source performance standard for insulation board and wet process hardboard plants calls for zero discharge. The control technology is the same for mechanical refining insulation board and thermo-mechanical insulation board. (That for S1S wet process hardboard and S2S wet process hardboard is also similar.) It consists of the following steps:

- Screening;
- Neutralization;
- Nutrient Addition;
- Aerated lagoon (two aerated lagoons for hardboard);
- Facultative lagoon; and
- Spray irrigation.

The characteristics of the model insulation board and hardboard plants are shown in Table IV-4.

TABLE IV-4

MODEL PLANTS FOR NEW SOURCE PERFORMANCE STANDARDS
INSULATION BOARD AND WET PROCESS HARDBOARD

Plant Type	Design Production		Wastewater Flow	Raw BOD Wasteload	Raw TSS Wasteload
	(tons/day)	(MMSF/yr., 1/8")	(000 gal./day)	(lbs/day)	(lbs/day)
Mechanical Refining					
Insulation Board					
Plant 1	250	264	0.5	7,510	9,170
Plant 2	600	635	1.2	18,000	22,000
Thermo-mechanical Refining					
Insulation Board					
Plant 1	200	212	0.5	22,400	6,410
Plant 2	400	425	1.0	44,800	12,800
S1S					
Wet Process Hardboard					
Plant 1	100	106	0.3	7,710	3,040
Plant 2	300	318	0.8	23,100	9,110
S2S					
Wet Process Hardboard					
Plant 1	250	264	1.5	32,500	7,510

Source: Environmental Science and Engineering, Inc.

2. Costs of Compliance

The costs of compliance for new insulation board and wet process hardboards plants are summarized in Table IV-5. Each new plant type requires substantial land for lagoons and other treatment steps. The investment and operating costs for pollution control are in the same range as those faced by the existing affected plants.

TABLE IV-5

COST OF COMPLIANCE:
NEW INSULATION BOARD AND WET PROCESS HARDBOARD MILLS
(1977 $000)

Plant Type	Total Investment	Operating Cost	Acres of Land Required	Annualized Cost
Mechanical Refining				
Insulation Board				
Plant 1	2,336	332	270	737
Plant 2	4,044	637	630	1,324
Thermo-mechanical Refining				
Insulation Board				
Plant 1	2,862	678	270	1,180
Plant 2	5,491	1,488	631	2,441
S1S				
Wet Process Hardboard				
Plant 1	1,953	323	159	667
Plant 2	2,915	445	437	941
S2S				
Wet Process Hardboard				
Plant 1	5,075	983	792	1,845

Sources: Reference 2 and Arthur D. Little, Inc., estimates.

V. ECONOMIC IMPACT OF COMPLIANCE WITH REVISED WATER EFFLUENT REGULATIONS

A. INTRODUCTION

The cost of compliance estimates generated by the Technical Contractor (Chapter IV) were combined with plant financial profiles and economic characteristics of the industry (Chapter III) to produce an estimate of the economic impact of revised water effluent regulations on the insulation board and wet process hardboard sectors of the timber industry.

Because there are so few plants in the insulation board and wet process hardboard sectors, and only seven wet process hardboard plants must incur costs to comply with revised water effluent regulations, an analysis of economic impact was performed for each affected plant.

The potential economic impacts discussed in this chapter include:

- price increases and demand shifts;
- financial considerations;
- plant closure;
- capacity expansion;
- market structure; and
- employment and community effects.

B. PRICE INCREASES

1. Level

The price increase required* to recover the cost of compliance varies widely among wet process hardboard plants (Table V-1). For the wet process hardboard plants, Option 1 (BPT) will have a lower effect upon price than Option 2 (BCT).

Plants 2002, 2003 and 2004 are required to make expenditures for pollution control under both options. For plant 2002 the required price increases to recover the cost of Option 1 (BPT) is about one percent of the 1977 aggregate average price of hardboard, while its required price increase to recover costs for Option 2 (BCT) is equivalent to 4%. For plant 2004 the required price increase to recover costs is higher than that for any other affected plant. Therefore, plant 2004 may not be able to recover its total compliance cost through long-term price increases for the industry overall if the higher incremental pollution control cost makes this plant a high-cost producer. For plant 2003, the required price increase is about the same under both options.

The differences in required price increase from plant to plant for a given model treatment can be explained by a combination of in-place treatment, production scale and/or special circumstances. For example, the four plants currently in compliance with Option 1 would incur lower costs to achieve Option 2 than the plants not in compliance with Option 1. Thus these four plants generally require lower price increases to recover costs.

The relative difference between Option 1 (BPT) and Option 2 (BCT) also differs from plant to plant. This reflects the differences in scale of operation and the treatment system currently in place. The smaller the plant, the larger the difference between Options 1 and 2 among the three plants affected by both options.

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* The revenue required to recover cost is equivalent to the annual revenue needed to yield the individual corporate rate of return over the life of the investment, using a discounted cash flow method of calculating return on investment.

TABLE V-1

REVENUE REQUIRED TO RECOVER
THE COST OF COMPLYING WITH REVISED REGULATIONS
FOR HARDBOARD PLANTS

Plant Type/Code	(1) 1976 Revenue ($000)	1976 Price* $/MSF	Recovery of Compliance Cost: Required Δ Revenue $/MSF	Recovery of Compliance Cost: % Δ 1976 Price ($/MSF)
Option 1				
Plant 2002	20,000	78	0.80	1
Plant 2003	>30,000	78	9.93	13
Plant 2004	8,400	78	9.96	14
Option 2				
Plant 2001	>30,000	78	4.02	5
Plant 2002	20,000	78	2.60	4
Plant 2003	>30,000	78	10.23	14
Plant 2004	8,400	78	17.94	23
Plant 2007	9,600	78	1.75	2
Plant 2012	>30,000	78	0.30	0
Plant 2099	5,500	78	8.30	11

*The average price for wet process hardboard for 1976.

Source: Arthur D. Little, Inc., estimates based upon EPA Financial Survey data and ESE cost estimates.

2. Obtainability

In evaluating economic impact, in addition to the long-term price increases that are necessary to recover the cost of compliance with revised water effluent regulations, it is important to determine if and when price increases can be obtained.

The first step in evaluating whether price increases can be obtained was to compare the capacity and production level in plants that are required to make expenditures for revised regulations with those that are not. Comparing the capacity of plants affected by Option 2 with that of plants currently in compliance, one finds that wet process hardboard plants affected by revised regulations represent 44% of the 1976 *total* (wet and dry) hardboard capacity and 45% of the total 1976 production (Table V-2). The tota. hardboard segments had an operating rate of 83% in 1976 while the affected plants operated at 85% of capacity. At traditional operating rates some long-term price increase will occur as a consequence of selecting Option 2, because so much industry capacity is affected by Option 2.*

* The intersection of the industry demand and supply curves traditionally has been between 65% and 95% (see Table III-4). Even if the affected plants were high-cost producers, price would increase to cover costs of some affected plants even at the lower end of the range.

TABLE V-2

DISTRIBUTION OF HARDBOARD CAPACITY
AFFECTED VS. NON-AFFECTED PLANTS
OPTION 2

	1976 Capacity (1/8" – MMSF)	% of Total	1976 Production 1/8" – MMSF	1976 Production % Total	1976 Capacity Utilization (%)
Wet Process					
Affected Plants (7)	3,409	44	2,897	45	85
Plants in Compliance (9)[1]	1,902	24	1,447	22	76
Total Wet Process (16)	5,311	68	4,344	67	82
Dry Process (12)	2,460	32	2,141	33	87
Total Hardboard	7,771	100	6,485	100	83

1. Includes two combination plants.

Source: Derived from Financial Survey and Table III-4.

Under Option 1 only three plants are affected and the affected plants represent 8% of hardboard capacity. Thus, the affected plants are less likely to recover the cost of compliance through long-term price increases until demand growth raises operating rates above 92%.

While current operating rates are important, future growth in demand and capacity expansion will indicate the probable supply/demand balance at the time the plants are required to make the pollution control investments. As previously discussed (Chapter III), hardboard demand will continue to grow at an average rate of 3% a year, while fluctuating with the business cycle for the construction industry. Insulation board, on the other hand, is a product in long-term decline. By 1984, demand for insulation board will be 65% of the 1976 level and, if all plants were in operation, the industry operating rate would be at about 60%.* The demand for hardboard will be about 40% higher in 1984 than in 1976 and an 1100-1200 MMSF of additional capacity will be required to meet the demand.**

Since hardboard is expected to be in tight supply on average over the next five to ten years, and the cost of new capacity cannot be supported by current market prices, eventually prices can be expected to cover the increased costs of existing hardboard producers. Thus supply/demand conditions in the long term may cause price increases sufficiently large to cover compliance cost.

The increases in price (measured in 1976 dollars) of hardboard under Options 1 and 2 will not generally be sufficient to negate its competitive advantage over other products. However, *even though demand is somewhat price inelastic*, some reductions in demand can occur. Under Option 2, while the cost of hardboard will still be lower than that of some substitutes, the required price increases will be large enough so that there could be some decline in product demand.

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* See Chapter II, Section C, for the data from which these figures were derived.
** See Chapter III, Section C, for the data from which these figures were derived.

C. FINANCIAL CONSIDERATIONS

When an industry can recover cost increases through price increases without affecting demand, the economic impact is less severe than it would otherwise be. However, plants may suffer adverse economic impact if price increases lag cost increases and if companies are unable to finance the compliance investment through internal funds or external sources.

The profitability of wet process hardboard plants affected by revised regulations was analyzed as if price increases did not occur (Figure V-1). The pollution control investment and operating costs were applied to the manufacturing cost data provided by each affected plant in the EPA Financial Survey, assuming price did not increase. In general, plant profitability will be reduced, but a plant will still cover its cash costs and depreciation, assuming that the 1976 operating results are representative of cost conditions likely to prevail in 1984. However, one plant would incur a loss under these assumptions.

Most of the insulation board and wet process hardboard plants are parts of larger corporations which generate cash flow in excess of the required pollution control investment and which also have some ability to generate external funds. However, a parent company might be reluctant to divert funds from other operations to hardboard plants. For this reason and because a few plants are part of smaller corporations, it is advisable to examine the relationship between plant cash flow and the required compliance investment.

The investment required for revised effluent regulations was divided by cash flow (Figure V-2). For wet process hardboard plants, the investment associated with Option 1 ranges up to about 300% of 1976 cash flow, while the investment associated with Option 2 could reach 330% of cash flow.*

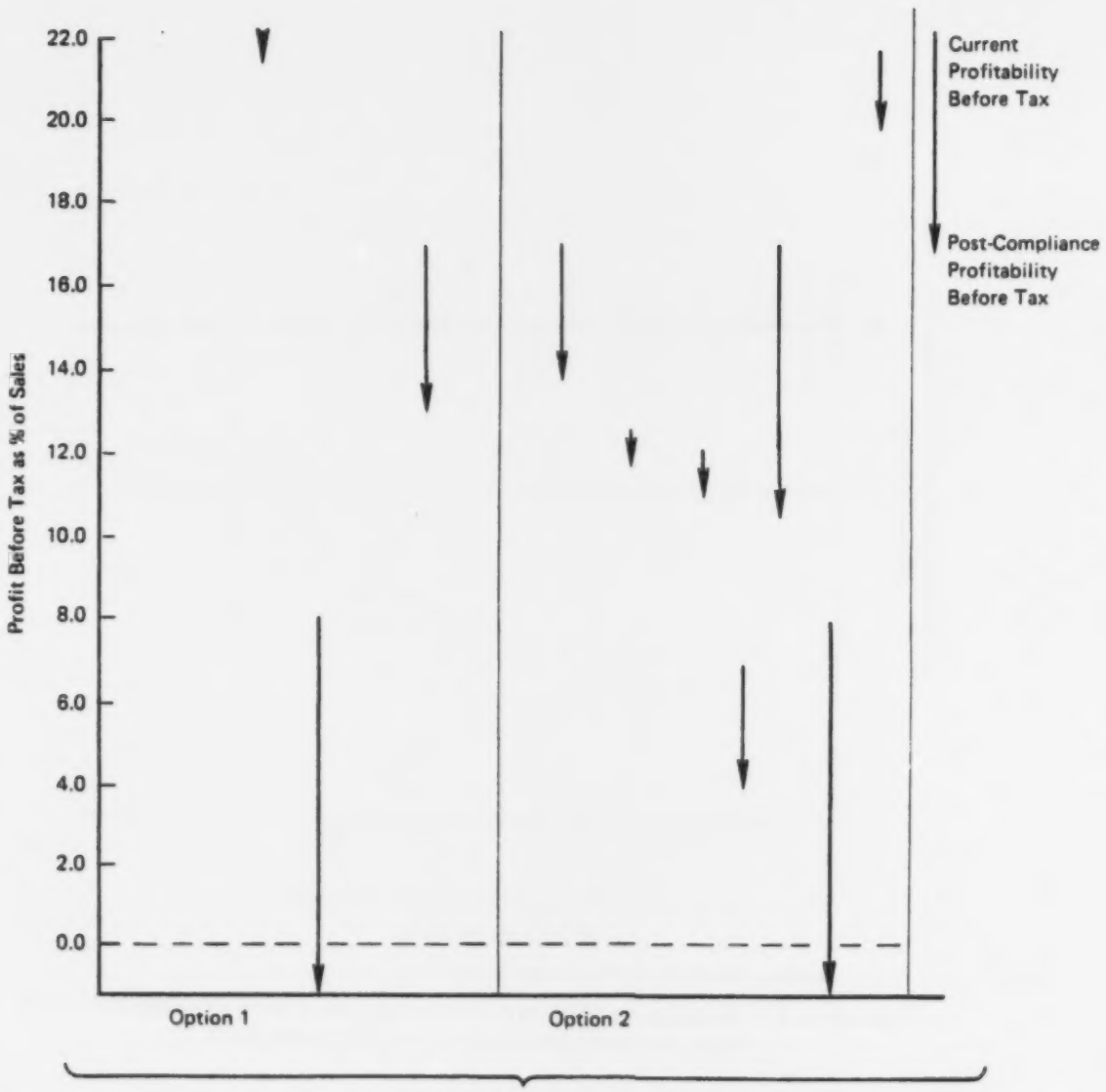
Most of the affected wet process hardboard plants will eventually recover the costs of compliance through higher prices. Also, in the long term, the industry rate of return on investment will not be adversely affected. However, the installation of pollution control equipment could cause a cash drain from other investments or operations.

D. PLANT CLOSURE

An evaluation of whether a plant will close down as a result of pollution control regulation (or any other event) based upon an external view of the plant's situation is, at best, imprecise. Of necessity, the evaluation is based upon financial criteria without knowledge and consideration of a corporation's policies and goals. To illustrate, a corporation may decide to close or sell an apparently profitable plant if the plant's business does not meet its long-term objectives. On the other hand, to retain control over the source of supply, a corporation may elect to invest in and operate a marginal plant which provides a source of equipment or materials for its other operations.

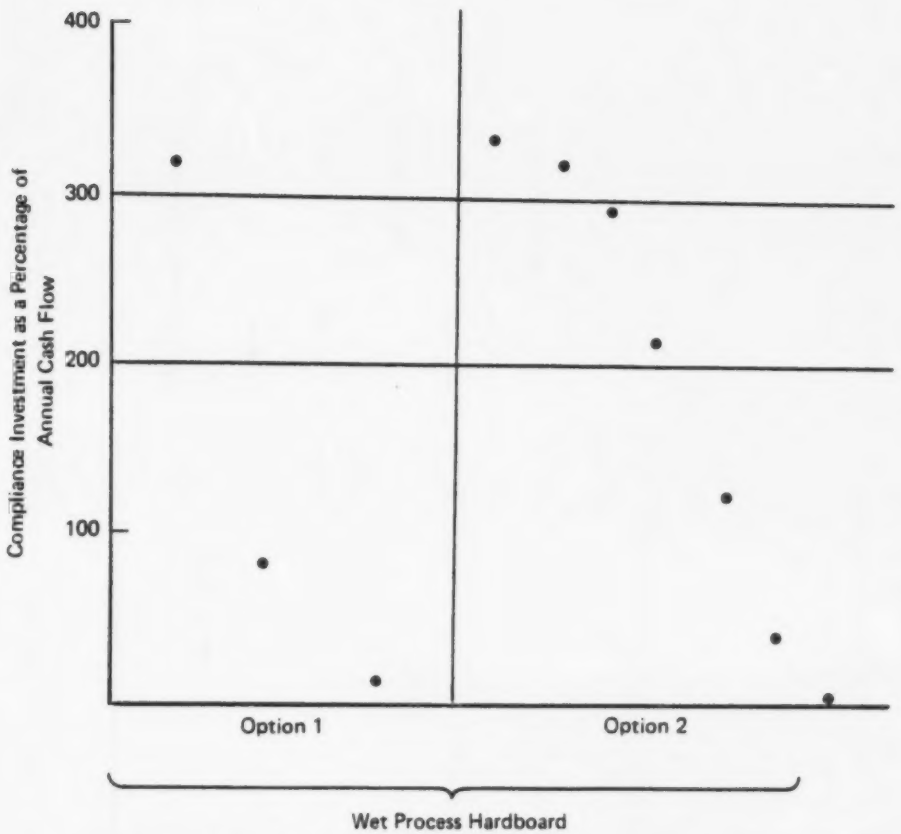
Under Options 1 and 2 one plant may close rather than invest in the pollution control equipment because profitability in the absence of price increases will become negative. However, these data do not reflect the anticipated real price increases that will occur by 1984 for hardboard which may allow the plant to maintain profitable operations. A second plant, which faces

*See Appendix C for sample calculation of cash flow.



Source: Arthur D. Little, Inc., estimates based upon EPA Financial Survey data and ESE cost of compliance estimates.

FIGURE V–1 POST-COMPLIANCE PROFITABILITY WITH NO PRICE INCREASE (1976 COST STRUCTURE)



Source: Arthur D. Little, Inc., estimates.

FIGURE V–2 INVESTMENT REQUIRED FOR COMPLIANCE WITH REVISED EFFLUENT REGULATIONS COMPARED WITH PLANT CASH FLOW

compliance investment equal to over 300% of cash flow under Option 2, will still enjoy an average industry operating margin even if prices do not increase. Thus, that plant will probably not close.

E. CAPACITY EXPANSION

Current industry participants do not plan to construct any greenfield plants to add to hardboard capacity. Arthur D. Little believes that the probable method of expansion, if any, would be incremental increases in capacity at existing plants and conversion of insulation board capacity to hardboard capacity. The total cost of production and derived selling prices based upon long-run total cost indicate that the price of hardboard must rise to a level substantially higher than the levels indicated in Table V-1 to support new capacity. Insulation board demand is facing a long-term decline and significant excess capacity by the 1980's; therefore, no new capacity will be built.

Capacity expansion for hardboard will most likely occur through incremental expansion of existing hardboard mills and secondarily from conversion of insulation board capacity. This is primarily attributable to the high cost of a new plant compared with current market prices. While this relationship would be exacerbated by pollution control costs, they are of secondary importance.

The required incremental price increase to cover pollution control costs* for a new source ($5/MSF) is within the range of that estimated to be required by a plant converted from insulation board to hardboard or an incrementally expanded hardboard plant (Table V-3). Thus, the pollution control requirements will not hinder capacity expansion.

All the expansion methods shown in Table V-3 require a higher product price than the current average market prices, suggesting that capacity increases will lag demand growth enough so that market price will rise to cover the costs of incremental capacity. The average 1978 market price was $93.95 per MSF; real prices must rise by 25% to support an incremental expansion by the lowest-cost method. This increase is greater than that required by affected hardboard plants to recover costs of pollution control costs under all of the options studied.

F. MARKET STRUCTURE

The number and size of future hardboard plants will be unaffected by revised regulations because the new source performance standards do not affect economies of scale. Further, the effect upon operating cost is within the range of that which would be incurred by existing affected plants. The one plant that may close has about 6% of industry capacity but its closure will not affect the number of companies in the industry. Any new capacity probably will be built at existing plants and will not be influenced significantly by revised regulations.

G. EMPLOYMENT AND COMMUNITY EFFECTS

As noted above, one plant may close rather than invest in additional controls. If so, from 250 to 400 jobs would be directly affected. In addition, since this plant is not located near major employment centers, secondary community effects could occur with decreases in the economic activity in the surrounding area.

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* The revenue required to recover cost is equivalent to the annual revenue needed to yield the individual corporate rate of return over the life of the investment, using a discounted cash flow method of calculating return on investment.

TABLE V-3

COST OF NEW HARDBOARD CAPACITY:
NEW MILL VERSUS INCREMENTAL EXPANSION
($1978)

	Capacity MMSF	Incremental Investment ($000)	Annual Operating Costs ($000)	Long-Run Price ($/MSF)
1. New Plant[1]				
Baseline Plant	300	57,000	24,200	136
Water Effluent Control	–	2,915	445	5
				141
2. Conversion of Insulation Board Plant				
Baseline Conversion Cost	234	27,000	20,440	117
Water Effluent Control (Option 2)[2]	–			2-14
				119-131
3. Incremental Expansion				
Baseline Expansion	117	17,500	8,370	106
Water Effluent Control (Option 2)[2]				2-14
				108-120

1. Costs of water effluent control are based upon ESE data for the new plant.
2. The range of long-run price increase for conversion/expansion plants is based upon the range calculated for existing plants of a similar size in Table V-1.

Sources: Reference 2 for water effluent control cost and Arthur D. Little, Inc., estimates of baseline cost.

VI. LIMITATIONS OF ANALYSIS

The economic impact of revised water effluent guidelines upon the wet process hardboard industry may differ from the analysis in this economic impact assessment, depending upon:

(1.) EPA regulations which affect waste disposal,

(2.) Future growth in demand, and

(3.) Unknown factors related to impacted plants.

Item (1) was beyond the scope of the Technical Contractor's and the Economic Contractor's work. Items (2) and (3) are limitations in every analysis of this type but their influence on the results of a study varies from case to case and thus requires discussion.

A. EPA's REGULATIONS AFFECTING WASTE DISPOSAL

Subtitle C of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), creates a regulatory framework to control hazardous wastes. Section 3004 addresses standards for owners and operators of hazardous waste treatment, storage and disposal facilities. Regulations issued under Subtitle C affect the analysis of alternative control options under the Clean Water Act. They specify the technical and monitoring requirements for hazardous waste disposal methods and their restrictions.

The solid wastes generated at wet process hardboard- and insulation board-producing plants have not been listed as hazardous in regulations recently promulgated under Subtitle C (RCRA).

B. FUTURE GROWTH IN DEMAND

If the construction and housing market growth inherent in the forecast of wet process hardboard growth does not materialize, then the affected plants will have difficulty in recovering costs of compliance. However, the Arthur D. Little forecast is generally regarded as conservative relative to other forecasts and thus this should not present a problem.

C. UNKNOWN FACTORS

The analysis of economic impact was based upon 1976 production and sales data and individual plants may not track industry trends. This could affect the ability of individual plants to increase price.

REFERENCES

1. *Revised Technical Review of Best Available Technology, Best Demonstrated Technology and Pretreatment Technology for the Timber Products Point Source Category,* report to the U.S. Environmental Protection Agency by Environmental Science and Engineering, Project No. 78-052, September 1, 1978.

2. *Development Document for Effluent Limitations Guidelines for the Timber Products Processing Point Source Category,* U.S. Environmental Protection Agency, EPA 440/1-79/023b, October 1979.

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APPENDIX A

SUPPLEMENTARY DATA

TABLE A-1

PRODUCTION OF INSULATING BOARD[1]

(density less than 31 pounds per cu. ft.)

SIC	Product	1976		1975		1974		1973	
		Short Tons	Thousand sq. ft. 1/2" Basis	Short Tons	Thousand sq. ft. 1/2" Basis	Short Tons	Thousand sq. ft. 1/2" Basis	Short Tons	Thousand sq. ft. 1/2" Basis
2661110	Structural insulating board, total	1,444,989	3,406,733	1,248,811	2,950,795	1,295,216	3,281,821	1,547,351	3,914,076
2661160	Insulating boards for the retail trade or for use directly in building construction, total	1,248,234	2,988,800	1,081,494	2,616,528	1,087,742	2,746,727	1,283,083	3,208,486
	Interior products, total	481,960	1,020,289	421,581	870,246	416,252	1,027,685	502,325	1,249,256
2661111	Building board, 7/16" or thicker, mostly painted or factory finished	169,772	401,786	117,811	267,746	127,643	309,176	164,239	398,032
2661113	Wallboard, under 7/16" thick, except thinglebacker	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
2661115	Sound-deadening board, nominal 1/2" thick, natural finish	23,399	46,405	13,680	37,248	28,194	76,310	36,587	101,306
2661121	Tile, except acoustical	166,305	321,339	206,192	371,082	164,031	403,663	194,882	484,664
2661123	Acoustical tile and lay on panels, acoustical	95,014	200,422	73,955	153,524	70,868	176,580	71,441	178,621
2661129	Other (including plank, trim, moldings, and other insulating board for retail used directly in interior building construction)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
	Exterior products, total	766,265	1,968,519	659,913	1,746,283	672,490	1,719,042	780,758	1,959,229
2661131	Sheathing board	575,199	1,367,602	483,792	1,172,905	515,937	1,308,254	619,436	1,591,961
2661133	Shinglebacker	19,484	52,054	(D)	(D)	(D)	(D)	24,687	66,293
2661135	Roof insulation board, preformed above deck	171,582	548,863	157,678	523,771	132,530	347,940	114,361	295,848
2661136	Insulating roof deck	(D)	(D)	(D)	(D)	(D)	(D)	2,274	6,137
2661138	Insulating fiberboard formboard								
	Insulating boards for industrial uses (for further manufacture, processing, or assembly), total	193,105	417,925	167,317	343,267	207,476	535,084	284,268	705,581
2661151	Insulating siding base	7,479	18,742	7,760	19,619	(D)	(D)	(D)	(D)
2661153	Trailer board	103,917	175,768	104,846	168,348	114,828	265,166	186,450	422,314
2661155	Backer board for siding made of metal	(D)	(D)	(D)	(D)	48,499	136,700	58,732	164,930
2661157	Insulating board for processing into expansion joint strips	(D)	(D)	16,087	41,939	21,950	75,947	18,716	68,367
2661159	Insulating board for all other industrial uses such as automobile industry, furniture industry, etc.	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)

1. The American Board Products Association does not agree with the Government's product mix data shown in this table.

D: Not disclosed

Source: U.S. Department of Commerce Current Industrial Reports, "Pulp, Paper, and Board" – M26A

TABLE A-1 (Continued)

PRODUCTION OF INSULATING BOARD[1]

(density less than 31 pounds per cu. ft.)

SIC	Product	1972		1971		1970		1969	
		Short Tons	Thousand sq. ft. 1/2" Basis	Short Tons	Thousand sq. ft. 1/2" Basis	Short Tons	Thousand sq. ft. 1/2" Basis	Short Tons	Thousand sq. ft. 1/2" Basis
2661110	Structural insulating board, total	1,538,534	2,917,742	1,445,835	2,838,953	1,218,531	3,163,714	1,362,314	3,584,675
2661160	Insulating boards for the retail trade or for use directly in building construction, total	1,266,721	3,199,718	1,196,334	3,147,684	1,004,667	2,606,405	1,163,675	3,068,502
	Interior products, total	486,371	1,285,782	470,183	1,251,552	386,830	1,021,376	456,507	1,201,362
2661111	Building board, 3/16" or thicker, mostly painted or factory finished	162,628	397,560	130,909	337,439	112,626	282,906	152,632	367,584
2661113	Wallboard, under 3/16" thick, except shingle backer	(D)	(D)	22,247	57,829	26,766	70,492	30,040	74,833
2661115	Sound-deadening board, nominal 1/2" thick, natural finish	40,412	113,882	36,399	100,683	28,556	70,990	34,712	95,887
2661121	Tile, except acoustical	196,027	530,440	204,807	554,996	164,448	413,256	168,477	436,686
2661123	Acoustical tile and lay-in panels, acoustical	58,942	171,780	63,579	177,605	50,922	143,172	63,480	161,816
2661129	Other (excluding plank, beam, molding, and other insulating board for retail use directly on interior building construction)	(D)	(D)	11,242	33,088	11,223	31,470	10,861	44,868
	Exterior products, total	779,350	1,830,461	726,151	1,896,132	617,837	1,587,029	706,373	1,867,150
2661131	Sheathing board	631,489	1,667,572	559,902	1,438,930	436,306	1,074,829	488,770	1,168,164
2661133	Shingle backer	23,150	62,479	17,168	46,782	18,804	47,008	31,035	78,204
2661135	Roof insulation board, perforated above deck	122,057	261,482	145,610	401,560	160,943	455,786	252,884	699,629
2661136	Insulating roof deck	2,654	6,928	3,471	8,860	3,584	9,406	5,484	14,153
2661138	Insulating fiberboard formboard								
	Insulating boards for industrial uses (for further manufacture, processing, or assembly), total	262,813	718,024	249,501	691,268	213,864	585,309	198,639	526,173
2661151	Insulating siding base	(D)	(D)	16,160	47,084	14,947	36,366	7,483	21,821
2661153	Trailer board	157,681	418,811	161,906	444,061	117,234	307,194	118,862	342,449
2661155	Backer board for siding made of metal	51,035	150,883						
2661157	Insulating board for processing into expansion joint strips	22,017	61,862	68,435	200,114	81,683	241,710	61,874	161,903
2661160	Insulating board for all other industrial uses such as automobile industry, furniture industry, etc.	(D)	(D)						

1. The American Board Products Association does not agree with the Government's product mix data shown in this table.

D Not disclosed

Source: U.S. Department of Commerce Current Industrial Reports, "Pulp, Paper, and Board" – M26A

TABLE A-2

DERIVATION OF UNIT COST
WET PROCESS HARDBOARD NEW CAPACITY

LABOR HOURS

1. Greenfield Mill

	Manhours/Ton
Logging	2.72
Manufacture	14.72
Transportation	2.08
	19.52

2. Conversion of Insulation Board to Hardboard
   Increase manhours by 10%: 21.42 manhours/incremental ton

3. Incremental Expansion
   Decrease manhours by 10%: 17.57 manhours/incremental ton

ENERGY REQUIREMENTS

1. Greenfield Mill

	Million Btu's
Gross Manufacturing Requirements	21.551
Energy Generated from Residue	.797
	20.754

2. Conversion of Insulation Board to Hardboard
   Increase Btu's by 10%: 22.829 million Btu's

3. Incremental Expansion
   Decrease Btu's by 10%: 18.679 million Btu's

WOOD REQUIREMENTS

300 tons of chips/day = 107 million board feet per day (MBF/day)
0.84 million square feet per day (MSF/day)

Source: Arthur D. Little, Inc., estimates.

APPENDIX B

EPA FINANCIAL SURVEY

TABLE B-1

RESPONSES TO EPA FINANCIAL SURVEY

Questionnaires Mailed to 18 Companies:

19 Wet Process Hardboard Mills
16 Insulation Board Mills

Response Rate: 100%

Applicable Responses Were Received For:

11 Wet Process Hardboard Only Mills*
11 Insulation Board Only Mills
5 Combination Mills

*Counting Abitibi's Alpena, Michigan operation as one mill.

Note: The Financial Survey was conducted in the autumn of 1977.

INSTRUCTIONS AND DEFINITIONS RELATING TO INSULATION BOARD

1. This survey must be completed by each manufacturing facility that manufactures insulation board.

2. A questionnaire for *each* insulation board plant has been sent to the corporate address. This may or may not be a plant site. All questions on a survey form refer to *one* particular insulation board plant site *only* and a separate questionnaire must be completed for each. Questionnaires were mailed to corporate offices because much of the information resides there and typically corporate involvement is required for response to materials of this kind.

3. Please submit one completed questionnaire for *each* plant in the enclosed, pre-addressed envelope by November 30, 1977.

4. All questions contained in this survey are intended to obtain information about your manufacturing operations and activities as they pertain to *insulation board manufacture only*. Other plant operations should not be considered in determining your responses unless a question specifically instructs you to do so.

5. A list of definitions of terms used in the survey has been provided to assist you in understanding the questions asked and to insure your interpretation of terms is the same as that of the persons who developed the survey. Please read these definitions prior to completing any questions and refer to them as often as necessary to assure accuracy in the completion of your response. Defined terms appear in *italics* in the questionnaire.

6. All questions should be answered by checking the appropriate box or boxes. Those questions requiring a written response should be answered by printing or typing in the appropriate space.

7. Attempt to answer all questions. Where appropriate, answers should be provided for the most recent fiscal year. If you cannot provide a full response to a question, answer as much of it as you can. If a question is not relevant to your plant operation or the information requested is not obtainable, please provide an explanation. If clarification or supplementation of any response is necessary, please attach a separate sheet. If you do not know the answer to a question, write "don't know" or "DK". If a value is zero, write in zero (0).

8. If you have difficulty understanding or answering any question, please call Stephen Mermelstein, 202-755-6906.

9. Please retain a copy of your completed survey, since it may be necessary to contact you in the future to verify your responses.

10. Definitions appear on the reverse of this page.

DEFINITIONS

Accumulated Depreciation–Total depreciation to date or the difference between original book value and current book value.

Annual Cost of Pollution Control and Other Environmental Regulations–Depreciation charges for pollution control equipment or for plant and equipment modifications required by regulations. Operating costs include the cost of maintenance and operating labor, supplies, fuel, and electricity required to operate the equipment related to the regulation.

Depreciation–Annual book depreciation of assets at this plant. *Do not include any Timberland Depletion in this figure.*

Direct Wages, Salaries and Related–Payroll costs (salaries, wages, unemployment insurance, FICA and other related costs) of direct labor (production employees) engaged in the manufacture of insulation board.

Fixed Assets–Capital assets, plant site land, and equipment are all categories of fixed assets. The book values or value net to depreciation or depletion should be shown. *Do not include any Timberland in this figure.*

Gross Fixed Assets–Original book value of Fixed Assets.

Insulation Board–A generic term for a homogeneous panel made from lignocellulosic fibers (usually wood or cane) characterized by an integral bond produced by inter-felting of the fibers, to which other materials may have been added during manufacture to improve certain properties, but which has not been consolidated under heat and pressure as a separate stage in manufacture, said board having a density of less than 31 lb/ft^3 (specific gravity 0.50) but having a density of more than 10 lb/ft^3 (specific gravity 0.16).

Materials Cost–Logs, wood, chips, chemicals and other supplies used in the production of insulation board.

Navigable Waters–Waters of the United States, including ocean, rivers, streams, etc. (surface water).

NPDES (National Pollutant Discharge Elimination System) Permit–A permit issued by EPA or an approved state program to point sources which discharge to public waters allowing the discharge of wastewater under certain stated conditions.

Operating Margin–Earnings before interest, taxes, general and administrative expense.

OSHA–The Occupational Safety and Health Administration.

Other Income (Expense)–Income (expense) not directly or indirectly associated with wet process hardboard manufacture.

Payback Period–The number of years it takes for an investment to repay itself.

Process Wastewater–Any used water which results from or has had contact with the manufacturing process, including any water for which there is a reasonable possibility of contamination from the insulation board manufacturing process or from raw material-intermediate product-final product, storage, transportation, handling, processing or cleaning. For purposes of this survey, cooling water, sanitary wastewater, store water and boiler blowdown are not considered process wastewater if they have no contact with the process.

Production Workers–Direct and indirect labor associated with and attributable to wood treating at this plant.

Profit After Tax–If this is a single-plant company, the net profit remaining after Federal Income taxes. If a multi-plant company, calculate an approximate profit after tax by using the aggregate corporate tax rate.

Profit Before Tax–Sales less all costs, except Federal Income taxes.

Return on Investment–The average annual increased revenue (or decreased cost) on an original investment, usually calculated by a discounted cash flow method, expressed as a percentage of original investment.

Sales–Sales, f.o.b. plant, net of discounts, and returns. If the plant is a cost center, estimate the approximate market value (f.o.b. plant) of the products produced in the most recent fiscal year.

Selling, General and Administrative Cost–Salaries, wages and related labor costs not directly associated with production activity; state and local taxes; insurance and expenses allocated from parent.

Total Assets–Fixed Assets, inventories, receivables, cash securities, et cetera.

Total Liabilities–Long-term debt, accounts and notes payable, deferred taxes, et cetera.

Unusual Production Costs–Any plant characteristic that causes unusual costs should be described as well as the impact upon operations. For example, if the plant is in a remote location, freight costs to the nearest market may be higher than those of other plants competing in the market.

308 QUESTIONNAIRE
INSULATION BOARD

i. Name of Plant _____

ii. Address of Plant _____
Street

_____
City State Zip

iii. Name of Respondent* _____ Title _____

iv. Address of Respondent _____
Street City State Zip

v. Telephone No. of Respondent _____
Area Code Number

vi. Parent Company _____

vii. Is this plant engaged in the manufacture of insulation board?

Yes ☐ Continue with Questionnaire

No ☐ Do not fill out the questionnaire but return after completing this page, through Question vii.

viii. To assert your claim of confidentiality, please check off the box corresponding to the questions that in the company's opinion require confidential treatment.

1	☐	5	☐	9	☐	13	☐	19	☐
2	☐	6	☐	10	☐	14	☐	20	☐
3	☐	7	☐	11	☐	15	☐	21	☐
4	☐	8	☐	12	☐	18	☐	22	☐

NOTE: Upon receipt by EPA, this page will be separated from the remainder of the questionnaire so that data processing and use is conducted on a coded basis.

For Use by EPA
Code Number _____

*Person to be contacted in case of questions.

308 QUESTIONNAIRE

INSULATION BOARD

Company Code _____

(For EPA Use)

A. GENERAL INFORMATION

1. Is this insulation board (IB) plant a stand-alone operation or part of a multi-plant complex?

   Stand-Alone ☐ Multi-plant Complex ☐

   If part of a multi-plant complex, approximately what percentage of total complex sales revenue was represented by insulation board in the fiscal year ending 1976? _____ %

2. Is this plant at an urban, suburban or rural location? _____

   Urban ☐ Suburban ☐ Rural ☐

3. What year did the plant begin operation? _____

B. SALES AND PRODUCT MIX

4. What were total sales for this insulation board (IB) plant during 1976?

Under $8 Million	$8-12 Million	$13-20 Million	$21-28 Million	Over $28 Million
☐	☐	☐	☐	☐

5. Which of the following product types were produced at this IB plant during 1976?

	Produced At Plant	Approximate Percent of *Sales*					
		< 10	10-30	31-50	51-70	71-90	> 90
Insulation Board							
a. Structural	☐	☐	☐	☐	☐	☐	☐
b. Decorative	☐	☐	☐	☐	☐	☐	☐
c. Other	☐	☐	☐	☐	☐	☐	☐

6. Are any changes (other than normal business fluctuations) planned over the next five years in IB production process or product mix?

   Yes ☐ No ☐ (If no, go to Part C)

   If yes, please describe: _____

   _____

C. PLANT CAPACITY AND PRODUCTION

7. Annual Capacity: The amount of thousands of square feet of insulation board which could have been produced in this plant during 1976 if the IB plant was operated fully 6-2/3 days/week, 24 hours/day, (350 days or 8400 hours/yr.).

	Thousands of Square Feet				
	< 100,000	100,000-150,000	150,001-200,000	200,001-250,000	250,001-300,000
Insulation Board (1/2" Basis)	☐	☐	☐	☐	☐
	300,001-350,000	350,001-400,000	400,001-450,000	450,001-500,000	> 500,000
	☐	☐	☐	☐	☐

8. Actual Production in 1976: The amount of thousands of square feet of insulation board which were produced in this IB plant during 1976:

Insulation Board (1/2" basis) _____ thousands of square feet

9. Did this IB plant have any unusual downtime during 1976, e.g., labor strikes, accidents, et cetera?

		Number of Weeks of Unusual Downtime					
		< 1	1-2	3-4	5-6	7-8	> 8
No ☐	(Go to 10)						
Yes ☐		☐	☐	☐	☐	☐	☐

10. Average number of employees during 1976:

	< 25	26-50	51-75	76-100	101-150	> 150
Production Workers	☐	☐	☐	☐	☐	☐
Other Employees	☐	☐	☐	☐	☐	☐

11. a. Typical number of production days per week:

1-4 ☐ 5 ☐ 6 ☐ 7 ☐

b. Please state number of weeks at each shift level (the total should add to 52 weeks)

No. of Weeks	
(1) _____	at 0 shifts (shut down or no insulation board production)
(2) _____	at 1 shift
(3) _____	at 2 shifts
(4) _____	at 3 shifts
(5) _____	at 4 shifts

52 weeks Total [(1) + (2) + (3) + (4) + (5)]

D. REVENUES AND EXPENSES

12. Income Statement

Please check the box which most closely approximates your costs as a percentage of sales. (Use an approximate allocation of data are available at the plant level.)

	Approximate Percent of *Sales*					
	< 16	16-20	21-25	26-30	31-35	> 35
a. *Direct Wages, Salaries and Related*	☐	☐	☐	☐	☐	☐
	< 40.0	41-45	46-50	51-55	56-60	> 60
b. *Materials* (logs, wood, other materials, inventory charges)	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	6-7	> 7
c. *Depreciation*	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	6-7	> 7
d. Other Plant Expenses (Including rent, fuel and energy)	☐	☐	☐	☐	☐	☐
	< 10	10.0-20.0	21.0-25.0		25.1-30.0	> 30
e. *Operating Margin*	☐	☐	☐		☐	☐
	< 8	8-10	11-13		> 14	
f. *Selling, General and Administration* (Including allocation from Parent)	☐	☐	☐		☐	
	0	1-2	3-4	5-6	7-8	> 8
g. Interest Expense	☐	☐	☐	☐	☐	☐
h. *Other Income (Expense)*	☐	☐	☐	☐	☐	☐
	< 3	3-9	10-12	13-15	16-17	> 17
i. *Profit Before Tax*	☐	☐	☐	☐	☐	☐
	< 1	2-3	4-5	6-7	8-9	> 9
j. Taxes	☐	☐	☐	☐	☐	☐
	< 2	2-4	5-10	11-15	>15	
k. *Profit After Tax*	☐	☐	☐	☐	☐	

13. How representative is 1976 profit before tax compared to the 1971-1975 period:

Much Better than Average	☐
Better than Average	☐
About the Same	☐
Worse than Average	☐
Much Worse than Average	☐

14. What Depreciation Method is used?

		Equipment	Buildings
a. Book Basis:	Straight-Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other: _____ (Please Specify)	☐	☐
b. Tax Basis:	Straight Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other: _____ (Please Specify)	☐	☐
c. Pollution Control Expenditures:			
	Accelerated Over 5 Years	☐	☐
	Same as Other Equipment	☐	☐

15. Annual Cost of Pollution Control and other Regulations Affecting Insulation Board Production Process and Costs at this IB Plant:

	Don't Know	None	Fiscal Year Ending 1976	Fiscal Year Ending 1977*
a. Direct Costs				
(1) Water Pollution Regulations:				
(a) Annual Operating Costs**	☐	☐	_____	_____
(b) Annual Depreciation Charges**	☐	☐	_____	_____
(c) Obligations to Municipalities	☐	☐	_____	_____
(2) Air Pollution Regulations:				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____

*Please estimate the 1977 value if unknown at this time.

**Include the cost associated with shared facilities, including Industrial Waste Recovery Systems.

	Don't Know	None	Fiscal Year Ending 1976	1977*
(3) Solid Waste Disposal (Total, including waste water sludge and wood waste):	☐	☐	_____	_____
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
(4) Other Regulations Affecting Production Processes and Production Costs (Please Specify): _____				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
b. Indirect Costs (e.g., environmental research, consultants, litigation)	☐	☐	_____	_____

16. How does this plant discharge of *process waste water*?

a. Discharge into navigable water ☐
b. Discharge into municipal sewer ☐
c. Disposed on plant site ☐
d. Disposed off plant site ☐
e. Process waste is recycled (no discharge) ☐
f. Other ☐ Please specify _____

17a. If you do not discharge *process waste water* into a municipal sewer, do you have the option to connect?

Yes ☐ No ☐ Don't Know ☐

b. If you do have the option to connect to a municipal sewer, what is the initial capital investment cost?

$ _____ Don't Know ☐

c. If you discharge any wood treating *process waste water* into a sewer system, on what basis are your sewer charges made?

Flat annual fee ☐
Gallon of effluent ☐
Other ☐ Please specify _____

*Please estimate the 1977 value if unknown at this time.

d. If you discharge into a municipal sewer, what were your total sewer charges in 1976?

$ _____

e. If you discharge *process waste water* into navigable waters, do you have an *NPDES permit*?

Yes ☐ No ☐ Don't Know ☐

f. Do you own or have available for purchase about one acre of land at or adjacent to this facility that could be used for an effluent treatment system?

Yes ☐ No ☐

If yes, what is the current market value per acre? $ _____

18. *Unusual Production Costs*

Are there any circumstances peculiar to this plant which result in unusual production costs (other than unusual downtime described in Q. 9)?

Yes ☐ No ☐

If Yes, please describe: _____

_____

_____

19. Distribution of Corporate Assets and Liabilities

a. What was the value of the company's *total assets* at the end of the 1976 fiscal year? $ _____

b. What was the value of the company's *total liabilities* and net worth at the end of the 1976 fiscal year (accounts payable, debt due within the year, etc.)? $ _____

c. What was the value of debt maturing in one year? $ _____

d. What was the corporation's debt/equity ratio? _____ :1

20 Value of Assets for this Insulation Board Plant

a. *Gross Fixed Assets*: Original Cost (Book Value) of plant and equipment dedicated to insulation board $ _____

b. Accumulated *depreciation* - _____

c. Net *Fixed Assets (Gross Fixed Assets* less cumulative *depreciation* = Current Book Value) $ _____

d. *Total Assets*: Net *Fixed Assets*, Cash Receivables, inventory, other costs) $ _____

21. Capital Investment Criteria for IB Plant

a. What basis is used to evaluate the IB plant's profitability (*return on investment*)?

- ☐ *Total Assets* (As above, 20.d) less current liabilities
- ☐ Book Value of Net *Fixed Assets* (As above, 20.c)
- ☐ Replacement Cost
- ☐ Salvage Value
- ☐ Other (Specify)

b. What is the target internal pre-tax rate of return on capital required for investment in this plant? _____ % At what ROI would you consider closing the plant? _____ %

c. If rate of return criteria are not used, what is the required *payback period* for investment? _____ Years or ☐ Useful Life. At what payback period would you consider closing the plant? _____ Years

22. Capital Investment for IB Plant (including capitalized maintenance)

	(1) Total Investment	(2) Plant Capitalized Maintenance of Major Expansion	(3) Water Pollution Control	(4) Other Environmental Regulation Impacting Production Processes
Planned 1977	_____	_____	_____	_____
Total Actual 1972-76	_____	_____	_____	_____

INSTRUCTIONS AND DEFINITIONS RELATING TO WET PROCESS HARDBOARD

1. This survey must be completed by each manufacturing facility that manufactures hardboard by the wet process.

2. A questionnaire for *each* hardboard plant has been sent to the corporate address. This may or may not be a plant site. All questions on a survey form refer to *one* particular hardboard plant site *only* and a separate questionnaire must be completed for each. Questionnaires were mailed to corporate offices because much of the information resides there and typically corporate involvement is required for response to materials of this kind.

3. Please submit one completed questionnaire for *each* plant in the enclosed, pre-addressed enveloped by November 30, 1977.

4. All questions contained in this survey are intended to obtain information about your manufacturing operations and activities as they pertain to *wet process hardboard manufacture only*. Other plant operations should not be considered in determining your responses unless a question specifically instructs you to do so.

5. A list of definitions of terms used in the survey has been provided to assist you in understanding the questions asked and to insure your interpretation of terms is the same as that of the persons who developed the survey. Please read these definitions prior to completing any questions and refer to them as often as necessary to assure accuracy in the completion of your response. Defined terms appear in *italics* in the questionnaire.

6. All questions should be answered by checking the appropriate box or boxes. Those questions requiring a written response should be answered by printing or typing in the appropriate space.

7. Attempt to answer all questions. Where appropriate, answers should be provided for the most recent fiscal year. If you cannot provide a full response to a question, answer as much of it as you can. If a question is not relevant to your plant operation or the information requested is not obtainable, please provide an explanation. If clarification or supplementation of any response is necessary, please attach a separate sheet. If you do not know the answer to a question, write "don't know" or "DK". If a value is zero, write in zero (0).

8. If you have difficulty understanding or answering any question, please call Stephen Mermelstein, 202-755-6906.

9. Please retain a copy of your completed survey, since it may be necessary to contact you in the future to verify your responses.

10. Definitions appear on the reverse of this page.

DEFINITIONS

Accumulated Depreciation–Total depreciation to date or the difference between original book value and current book value.

Annual Cost of Pollution Control and Other Environmental Regulations–Depreciation charges for pollution control equipment or for plant and equipment modifications required by regulations. Operating costs include the cost of maintenance and operating labor, supplies, fuel, and electricity required to operate the equipment related to the regulation.

Depreciation–Annual book depreciation of assets at this plant. *Do not include any Timberland Depletion in this figure.*

Direct Wages, Salaries and Related–Payroll costs (salaries, wages, unemployment insurance, FICA and other related costs) of direct labor (production employees) engaged in the manufacture of wet process hardboard.

Fixed Assets–Capital assets, plant site land, and equipment are all categories of fixed assets. The book values or value net to depreciation or depletion should be shown. *Do not include any Timberland in this figure.*

Gross Fixed Assets–Original book value of Fixed Assets.

Hardboard–A generic term for a panel manufactured primarily from inter-felted lignocellulosic fibers (usually wood), consolidated under heat and pressure in a hot-press to a density of 31 lb/ft^3 (specific gravity 0.50) or greater, and to which other materials may have been added during manufacture to improve certain properties.

Materials Cost–Logs, wood, chips, chemicals and other supplies used in the production of wet process hardboard.

NPDES (National Pollutant Discharge Elimination System) Permit–A permit issued by EPA or an approved state program to point sources which discharge to public waters allowing the discharge of wastewater under certain stated conditions.

Navigable Waters–Waters of the United States including ocean, rivers, streams, etc. (surface water).

Operating Margin–Earnings before interest, taxes, general and administrative expense.

OSHA–The Occupational Safety and Health Administration.

Other Income (Expense)–Income (expense) not directly or indirectly associated with wet process hardboard manufacture.

Payback Period–The number of years it takes for an investment to repay itself.

Process Wastewater–Any used water which results from or has had contact with the manufacturing process, including any water for which there is a reasonable possibility of contamination from the wet process hardboard manufacturing process or from raw material-intermediate product-final product, storage, transportation, handling, processing or cleaning. For purposes of this survey, cooling water, sanitary wastewater, storm water and boiler blowdown are not considered process wastewater if they have no contact with the process.

Production Workers–Direct and indirect labor engaged in and attributable to the production of wet process hardboard at this plant.

Profit After Tax–If this is a single-plant company, the net profit remaining after Federal Income taxes. If a multi-plant company, calculate an approximate profit after tax by using the aggregate corporate tax rate.

Profit Before Tax–Sales less all costs, except Federal Income taxes.

Return on Investment–The average annual revenue (or decreased cost) on an original investment, usually calculated by a discounted cash flow method.

Sales–Sales, f.o.b. plant, net of discounts, and returns. If the plant is a cost center, estimate the approximate market value (f.o.b. plant) of the products produced in the most recent fiscal year expressed as a percent of the original investment.

Selling, General and Administrative Cost–Salaries, wages and related labor costs not directly associated with production activity; state and local taxes; insurance and expenses allocated from parent.

Total Assets–Fixed Assets, inventories, receivables, cash securities, et cetera.

Total Liabilities–Long-term debt, accounts and notes payable, deferred taxes, et cetera.

Unusual Production Costs–Any plant characteristic that causes unusual costs should be described as well as the impact upon operations. For example, if the plant is in a remote location, freight costs to the nearest market may be higher than those of other plants competing in the market.

308 QUESTIONNAIRE
WET PROCESS HARDBOARD

i. Name of Plant _____

ii. Address of Plant _____
Street

_____
City State Zip

iii. Name of Respondent* _____ Title _____

iv. Address of Respondent _____
Street City State Zip

v. Telephone No. of Respondent _____
Area Code Number

vi. Parent Company _____

vii. Is this plant engaged in the manufacture of insulation board?

Yes ☐ Continue with Questionnaire

No ☐ Do not fill out the questionnaire but return after completing this page through Question vii.

viii. To assert your claim of confidentiality, please check off the box corresponding to the questions that in the company's opinion require confidential treatment.

1	☐	5	☐	9	☐	13	☐	19	☐
2	☐	6	☐	10	☐	14	☐	20	☐
3	☐	7	☐	11	☐	15	☐	21	☐
4	☐	8	☐	12	☐	18	☐	22	☐

NOTE: Upon receipt by EPA, this page will be separated from the remainder of the questionnaire so that data processing and use is conducted on a coded basis.

For Use by EPA

Code Number _____

*Person to be contacted in case of questions.

308 QUESTIONNAIRE
WET PROCESS HARDBOARD

Company Code _____
(For EPA Use)

A. GENERAL INFORMATION

1. Is this wet process *hardboard* (WPH) plant a stand-alone operation or part of a multi-plant complex?

   Stand-Alone ☐ Multi-plant Complex ☐

   If part of a complex, approximately what percentage of total *sales* at this complex was from wet process hardboard in the 1976 fiscal year? _____ %

2. Is this plant at an urban, suburban or rural location?

   Urban ☐ Suburban ☐ Rural ☐

3. What year did the plant begin operation? _____

B. SALES AND PRODUCT MIX

4. What were total *sales* (net f.o.b.) for this wet process hardboard (WPH) plant during 1976?

Under $5 Million	$5-10 Million	$11-20 Million	$21-30 Million	More than $30 Million
☐	☐	☐	☐	☐

5. Which of the following product types were produced at this WPH plant during 1976?

S1S Products	Produced At Plant	Approximate Percent of *Sales*					
		< 10	10-30	31-50	51-70	70-90	> 90
a. Siding	☐	☐	☐	☐	☐	☐	☐
b. Panelling	☐	☐	☐	☐	☐	☐	☐
c. Industrial Board	☐	☐	☐	☐	☐	☐	☐
d. Other S1S	☐	☐	☐	☐	☐	☐	☐
S2S Products							
e. Siding	☐	☐	☐	☐	☐	☐	☐
d. Panelling	☐	☐	☐	☐	☐	☐	☐
g. Industrial Board	☐	☐	☐	☐	☐	☐	☐
h. Other S2S	☐	☐	☐	☐	☐	☐	☐

6. Are any changes (other than normal business fluctuations) planned over the next five years in production process or product mix at this WPH plant?

   Yes ☐ No ☐ (If no, go to Part C)

   If yes, please describe _____

   _____

   _____

C. PLANT CAPACITY AND PRODUCTION

7. Annual Capacity: The amount of thousands of square feet of the product which could have been produced in this plant during 1976 if the plant was operated fully 6-2/3 days/week, 24 hours/day (350 days or 8400 hours/yr.).

	Thousands of Square Feet				
	< 100,000	100,000-150,000	150,001-200,000	200,001-250,000	250,001-300,000
Wet Process Hardboard (1/8" Basis)	☐	☐	☐	☐	☐
	300,001-350,000	350,001-400,000	400,001-450,000	450,001-500,000	> 500,000
	☐	☐	☐	☐	☐

8. Actual Production in 1976: The amount of thousands of square feet of the product which were produced in this plant during 1976:

Wet Process Hardboard (1/8" basis) _____ thousands of square feet

9. Did this WPH plant have any unusual downtime during 1976, e.g., labor strikes, accidents, etc?

	Number of Weeks of Unusual Downtime					
	< 1	1-2	3-4	5-6	7-8	> 8
No ☐ (Go to 10)						
Yes ☐	☐	☐	☐	☐	☐	☐

10. Average number of employees during 1976:

	< 25	26-50	51-75	76-100	101-150	> 150
Production Workers	☐	☐	☐	☐	☐	☐
Other Employees	☐	☐	☐	☐	☐	☐

11. a. Typical number of production days per week:

1-4 ☐ 5 ☐ 6 ☐ 7 ☐

b. Please state number of weeks at each shift level (the total should add to 52 weeks):

No. of Weeks	
(1) _____	at 0 shifts (shut down or no wet process hardboard production)
(2) _____	at 1 shift
(3) _____	at 2 shifts
(4) _____	at 3 shifts
(5) _____	at 4 shifts
52 Weeks	Total [(1) + (2) + (3) + (4) + (5)]

D. REVENUES AND EXPENSES

12. Income Statement

Please check the box which most closely approximates your costs as a percentage of sales. (Use an approximate allocation if data are unavailable at the plant level.)

	This WPH Plant's Cost as an Approximate Percent of *Sales*					
	< 16	17-19	20-23	24-26	27-29	> 29
a. *Direct Wages, Salaries and Related*	☐	☐	☐	☐	☐	☐
	< 20	21-27	28-33	34-40	41-47	> 47
b. *Materials* (logs, wood, other materials plus inventory charges)	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	6-7	> 7
c. *Depreciation*	☐	☐	☐	☐	☐	☐
	< 1	1-2	3-4	4-5	5-6	> 7
d. Other Plant Expenses (Including rent, fuel and energy)	☐	☐	☐	☐	☐	☐
	< 30	31-35	36-40	41-45	46-50	> 50
e. *Operating Margin*	☐	☐	☐	☐	☐	☐
	< 5	6-7	8-10	11-12	13-15	> 15
f. *Selling General and Admin.* (Including Allocation from Parent)	☐	☐	☐	☐	☐	☐
	0	1-2	3-4	5-6	> 6	
g. Interest Expense	☐	☐	☐	☐	☐	
h. *Other Income (expense)*	☐	☐	☐	☐	☐	
	< 10	11-14	15-19	19-24	25-30	
i. *Profit Before Tax*	☐	☐	☐	☐	☐	
	< 4	5-6	7-9	10-12	13-15	
j. Taxes	☐	☐	☐	☐	☐	
	< 4	5-6	7-9	10-12	13-15	
k. *Profit After Tax*	☐	☐	☐	☐	☐	

13. How representative is 1976 profit before tax compared to the 1971-1975 period:

Much Better than Average	☐
Better than Average	☐
About the Same	☐
Worse than Average	☐
Much Worse than Average	☐

14. What depreciation method is used?

		Equipment	Buildings
a. Book Basis:	Straight-Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other: _____ (Please Specify)	☐	☐
b. Tax Basis:	Straight Line	☐	☐
	Double-declining Balance	☐	☐
	Sum of Year's Digits	☐	☐
	Other: _____ (Please Specify)	☐	☐
c. Pollution Control Expenditures:			
	Accelerated Over 5 Years	☐	☐
	Same as Other Equipment/Bldgs.	☐	☐

15. Annual Cost of Pollution Control and other Regulations Affecting WPH Production Process and Production at this Plant:

	Don't Know	None	Fiscal Year Ending 1976	Fiscal Year Ending 1977*
a. Direct Costs				
(1) Water Pollution Regulations:				
(a) Annual Operating Costs**	☐	☐	_____	_____
(b) Annual Depreciation Charges**	☐	☐	_____	_____
(c) Obligations to municipalities	☐	☐	_____	_____
(2) Air Pollution Regulations:				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____

*Please estimate 1977 expenditures if they are not known.

**Include the cost associated with shared facilities, including Industrial Waste Recovery Systems.

	Don't Know	None	Fiscal Year Ending 1976	1977*
(3) Solid Waste Disposal (Total, including waste water sludge and wood waste):	☐	☐	_____	_____
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
(4) Other Regulations Affecting Production Processes and Production Costs (Please Specify): _____				
(a) Annual Operating Costs	☐	☐	_____	_____
(b) Annual Depreciation Charges	☐	☐	_____	_____
b. Indirect/Overhead Costs (Environmental research, consulting fees, litigation, etc.)	☐	☐	_____	_____

16. How does this plant dispose of *process waste water*?

a. Discharge into navigable water ☐
b. Discharge into municipal sewer ☐
c. Disposed on plant site ☐
d. Disposed off plant site ☐
e. Process waste water is recycled (no discharge) ☐
f. Other ☐ Please specify _____

17.a If you do not discharge *process waste water* into a municipal sewer, do you have the option to connect?

Yes ☐ No ☐ Don't Know ☐

b. If you do have the option to connect to a municipal sewer, what is the initial capital investment cost?

$ _____ Don't Know ☐

c. If you discharge any *process waste water* into a sewer system, on what basis are your sewer charges made?

Flat annual fee ☐
Gallon of effluent ☐
Other ☐ Please specify _____

*Please estimate the 1977 value if unknown at this time.

d. If you discharge into a municipal sewer, what were your total sewer charges in 1976?

$ _____

e. If you discharge *process waste water* into navigable waters, do you have an *NPDES Permit*?

Yes ☐ No ☐ Don't Know ☐

f. Do you own or have available for purchase about one acre of land at or adjacent to this facility that could be used for an effluent treatment system?

Yes ☐ No ☐

If yes, what is the current market value per acre? $ _____

18. *Unusual Production Costs*

Are there any circumstances peculiar to this plant which result in unusual production costs (other than unusual downtime described in Q. 9)?

Yes ☐ No ☐

If Yes, please describe: _____

_____

_____

19. Distribution of Corporate Assets and Liabilities

a. What is the value of the corporation's total accounts receivable? $ _____

b. What is the value of the corporation's total current liabilities (accounts payable, debt due within the year, etc.)? $ _____

c. What is the value of debt maturing in the current fiscal year? $ _____

d. What is the corporate debt/equity ratio? _____ :1

20. Value of Assets (Wet Process Hardboard Plant):

a. *Gross Fixed Assets*: Original Cost (Book Value) of plant equipment dedicated to wet process hardboard $ _____

b. Accumulated *depreciation* - _____

c. Net *Fixed Assets (Gross Fixed Assets* less cumulative *depreciation*–Current Book Value) $ _____

d. *Total Assets*: Net *Fixed Assets*, Cash Receivables, inventory, other costs) $ _____

21. Capital Investment Criteria for WPH Plant

a. What basis is used to evaluate the plant's profitability (return on investment)?

☐ Net Assets (Total Assets, as above in 20.d, less Current Liabilities)

☐ Book Value of Net Fixed Assets (as above in 20.c)

☐ Replacement Cost

☐ Salvage Value

☐ Other (Specify) _____

b. What is the target internal pre-tax rate of return on capital required for investment in this plant? _____ % At what ROI would you consider closing the plant? _____ %

c. If rate of return criteria are not used, what is the required *payback period* for investment? _____ Years or ☐ Useful Life

22. Capital Investment for WPH Plant (including capitalized maintenance)

	(1) Total Investment	(2) Plant Capitalized Maintenance of Major Expansion	(3) Water Pollution Control	(4) Other Regulation Production	(4) Environmental Impacting Processes
Planned 1977	_____	_____	_____	_____	
Total Actual 1972-76	_____	_____	_____	_____	

APPENDIX C

SAMPLE CALCULATIONS

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SAMPLE CALCULATIONS

1. CASH FLOW

In this study, plant cash flow was defined as profit after tax plus depreciation. Individual plant data from the EPA Financial Survey were used to estimate each plant's cash flow. The pro-forma data were multiplied by plant sales to estimate the dollar value of cost items in 1976.

The following example illustrates the calculation procedure:

	Item	Plant Cost Structure Percent
(1)	Sales	100
(2)	Direct Labor	25
(3)	Materials	40
(4)	Depreciation	3
(5)	Other Expenses	10
(6)	Cost of Goods Sold	78
(7)	Operating Margin	22
(8)	Selling G&A	11
(9)	Profit Before Tax	11
(10)	Tax	5
(11)	Profit After Tax	6

Cash flow is equal to depreciation (Item 4) plus profit after tax (Item 11).

The calculated cash flow represents gross cash flow and approximates total funds available from plant operations. The uses of funds include investments in capital equipment, debt repayment, increases in working capital and dividend payments. Thus, only some portion of a plant's annual cash flow would be available to fund pollution control investment.

If internal cash flow is insufficient to cover all the requirements for funds, other sources of funds, such as new debt or new equity, must be found.

2. ANNUALIZED COSTS

The costs of complying with water pollution control regulations can require investment in land and equipment and the annual operating expense to run the equipment. The cash expenditures that are required are thus uneven over time for a single plant, and differ by regulatory option.

To provide a basis of comparison among regulatory options, it is useful to present the *annualized cost* of each alternative. A common approach that has been used in numerous studies

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is to calculate a capital recovery factor for investments and add that to operating cost to obtain annualized cost. The formula for the capital recovery factor (CRF) is:

$$CRF = \frac{r\,(1+r)^t}{[\,(1+r)^t\,] - 1}$$

where: r = after-tax cost of capital, and

t = depreciable life of asset

Investments in land cannot be depreciated. Therefore, the CRF for land is equal to the after-tax cost of capital. For other investments the depreciable life determines the value of the factor. The shorter the life of equipment, the larger the CRF. In this report, eleven years was used as the average life.

In this report, the cost of capital used in the calculation of CRF for individual companies was derived from the EPA Financial Survey. The following rate-of-return criteria and CRF's apply to one or more plants.

After-Tax Return on Investment	CRF
0.09	0.1469
0.12	0.1684
0.14	0.1834
0.20	0.2311

The EPA Development Document[2] contains annual costs which include a capital recovery factor based upon a 20-year useful life and an after-tax cost of capital equal to 10%. The *annual operating* cost figures shown throughout this report exclude a capital recovery cost, whereas the *annualized* cost figures include the capital recovery cost calculated using the plant-specific capital recovery factors.